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SAN JOAQUIN RIVER BASIN, LOWER SAN JOAQUIN RIVER, CA: INTEGRATED INTERIM FEASIBILITY REPORT, ENVIRONMENTAL IMPACT STATEMENT, AND ENVIRONMENTAL IMPACT REPORT

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF DEFENSE

TRANSMITTING

THE CORPS' REPORT ON SAN JOAQUIN RIVER BASIN, LOWER SAN JOAQUIN RIVER, CA: INTEGRATED INTERIM FEASIBILITY REPORT, ENVIRONMENTAL IMPACT STATEMENT, AND ENVIRONMENTAL IMPACT REPORT FOR JANUARY 2018

MARCH 28, 2019.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

FEB - 7 2019

The Honorable Nancy Pelosi
Speaker of the House
U.S. House of Representatives
Washington, D.C. 20515

Dear Ms. Speaker:

In response to a resolution provided by the Committee on Public Works of the United States House of Representatives, adopted May 8, 1964, the Secretary of the Army recommends a flood risk management project for the Lower San Joaquin River. The proposal is described in the report of the Chief of Engineers, dated July 31, 2018, which includes other pertinent documents. The Secretary of the Army plans to implement the project at the appropriate time, considering National priorities and the availability of funds.

The project study was conducted to analyze and formulate improvements for reducing flood damages within the Lower San Joaquin River basin, California. The recommended plan reduces flood risk by addressing problems associated with seepage, stability, and erosion for the levees along the San Joaquin River, Calaberas River, Fourteenmile Slough, Tenmile Slough, and Mosher Slough. The recommended plan is the National Economic Development (NED) plan referred to as Alternative 7a – North and Central Stockton, Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements. The recommended plan is also the environmentally preferable alternative and includes the following elements:

a. Delta Front: 3.05 miles of fix in place improvements with soil-bentonite cutoff walls of various depths with 2.5 miles of geometry improvement. 1.1 miles of seismic fixes through deep soil mixing in North Stockton along two segments of Tenmile Slough. 1.33 miles of new setback levee along the Delta Front to eliminate the eastern portions of the Fourteenmile Slough levee in North Stockton. Height improvements between 1.8 and 2.7 feet for 0.59 miles on the Delta Front. Erosion protection is required for 5 miles, and a control structure on Fourteenmile Slough.

b. North Stockton: 9.4 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in North Stockton. 2.03 miles of height improvements between 1.4 and 1.6 feet in North Stockton.

c. Central Stockton: 9.2 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in Central Stockton. 2 miles of levee geometry improvements in Central Stockton along one segment of the Calaveras River and one segment of the San Joaquin River. 0.53 miles of height improvements of 1.8 feet in Central Stockton. 0.75 miles of new levee with soil-bentonite cutoff wall on Duck Creek to address

flanking of flood waters from south of Central Stockton. 0.28 miles of height improvements of 4 feet on the RD 404 levee. Control Structure at Smith Canal with 0.2 miles of floodwall.

Based on October 2018 (Fiscal Year 2019) price levels, the estimated total first cost of the NED plan is $1,095,644,000. The Federal share of the estimated first cost of initial construction is currently estimated at $712,169,000. The non-Federal cost share of the NED plan is $383,475,000. The non-Federal share includes the cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas which are estimated at $158,089,000. The non-Federal sponsors (State of California and the San Joaquin Area Flood Control Agency) would be responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project after construction currently estimated at about $1,170,000 per year.

Based on Fiscal Year 2019 price levels, a discount rate of 2.875-percent, and a 50-year period of analysis, the total average annual costs of the project are estimated to be $52,211,000, including OMRR&R. The recommended plan would reduce average annual flood damages by about 83 percent and would leave average annual residual damages estimated at $69,170,000. Average annual economic benefits are estimated to be $359,957,000. The net average annual benefits are approximately $307,747,000. The benefit-to-cost ratio is 6.89 to 1.

An Environmental Impact Statement and a Record of Decision was prepared in accordance with the National Environmental Policy Act. All practicable means to avoid and minimize adverse environmental effects have been incorporated into the recommended plan. USFWS and NMFS both determined that the project, including the Corps' proposed compensatory mitigation plan, will not jeopardize the existence of Federally listed species or adversely modify or destroy designated critical habitat. All terms and conditions resulting from these consultations shall be implemented in order to minimize take of threatened and endangered species.

Independent External Peer Review (IEPR) was conducted for the study in accordance with Section 2034 of WRDA 2007, EC 1165-2-214 and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004). The IEPR panel reviewed the Integrated Feasibility Report and EIS as well as supporting documentation. The Final IEPR Battelle Report was issued on May 8, 2015. Overall, eight (8) comments were identified and documented. The panel concurred with all 8 responses.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress. However, OMB also noted that the project would need to compete with other proposed investments for funding in future budgets. A copy of OMB's letter, dated January 28, 2019, is enclosed. I am providing a copy of this transmittal and the OMB letter to the Subcommittee on Water Resources and Environment of the House Committee on Transportation and Infrastructure, and the

Subcommittee on Energy and Water Development of the House Committee on Appropriations. I am also providing an identical letter to the President of the Senate.

Sincerely,

R.D. James
Assistant Secretary of the Army
(Civil Works)

Enclosures

5 Enclosures

1. Report of the Chief of Engineers, July 31, 2018
2. Record of Decision, February 8, 2019
3. OMB Clearance Letter, January 28, 2019
4. State and Agency Review Letters
5. Lower San Joaquin River, CA, Final Integrated Interim Feasibility Report and Environmental Impact Statement / Environmental Impact Report, February 2018

DEPARTMENT OF THE ARMY
CHIEF OF ENGINEERS
2600 ARMY PENTAGON
WASHINGTON, D.C. 20310-2600

JUL 3 1 2018

DAEN

SUBJECT: Lower San Joaquin River Flood Risk Management Feasibility Study Report, California

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on the study of flood risk management along the San Joaquin River within the metropolitan area of Stockton, California. It is accompanied by the report of the Sacramento District Engineer and the South Pacific Division Engineer. These interim reports are in partial response to the resolution adopted by the Committee on Public Works of the House of Representatives, adopted May 8, 1964. The resolution requested a review of "the reports on the Sacramento-San Joaquin Basin Streams, California, published in House Document No. 367, 81st Congress, 1st session and other reports, with a view to determine whether any modifications to the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California." Reports related to flood control investigations in the San Joaquin River Basin were initially authorized by Sections 2 and 6 of the Flood Control Act of 1936, Public Law 74-738. House Report 105-190, which accompanied the Energy and Water Development Appropriations Act, 1998, Public Law 105-62, identified initial funding and directed the U.S. Army Corps of Engineers (Corps) to conduct a comprehensive study under the 1964 study authority. As the present report addresses flood risk management concerns in only a portion of the study area, I recommend continuing work under the existing study in order to determine the feasibility of flood risk management plan alternatives for other locations covered by the study authority, including but not limited to the area designated as Reclamation District 17, as well as the cities of Lathrop and Manteca.

2. The reporting officers recommend authorizing a plan to reduce flood risk by reducing the problems associated with seepage, stability and erosion for the levees along the San Joaquin River, Calaveras River, Fourteenmile Slough, Tenmile Slough, and Mosher Slough. The recommendation is supported by the non-federal sponsors, the San Joaquin Area Flood Control Agency (SJAFCA) and the State of California. The principal features of the recommended plan by reach are:

Delta Front

- 3.05 miles of fix in place improvements with soil-bentonite cutoff walls of various depths with 2.5 miles of geometry improvement.

- 1.1 miles of seismic fixes through deep soil mixing in North Stockton along two segments of Tenmile Slough.

ENCL 1

- 1.33 miles of new setback levee along the Delta Front to eliminate the eastern portions of the Fourteenmile Slough levee in North Stockton.
- 0.59 miles of height improvements between 1.8 and 2.7 feet on the Delta Front.
- 5 miles of erosion protection.
- Control Structure on Fourteenmile Slough.

North Stockton

- 9.4 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in North Stockton.
- 2.03 miles of height improvements between 1.4 and 1.6 feet in North Stockton.

Central Stockton

- 9.2 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in Central Stockton.
- 2 miles of levee geometry improvements in Central Stockton along one segment of the Calaveras River and one segment of the San Joaquin River.
- 0.53 miles of height improvements of 1.8 feet in Central Stockton.
- 0.75 miles of new levee with soil-bentonite cutoff wall on Duck Creek to address flanking of flood waters from south of Central Stockton.
- 0.28 miles of height improvements of 4 feet on the RD 404 levee.
- Control Structure at Smith Canal with 0.2 miles of floodwall.

The recommended plan requires the non-federal sponsors prepare a Floodplain Management Plan, as required for all Corps flood risk management projects per Section 402 of the Water Resources Development Act (WRDA) of 1986, as amended.

There are 14.2 miles of existing federal levee segments within the recommended plan. A total of 9.5 miles of existing non-federal levee and 0.75 miles of newly constructed levee will be added to the federal levee system as part of the recommended plan.

3. The recommended plan is the NED Plan and would reduce flood risk to the City of Stockton. The proposed project would reduce Expected Annual Damages (EAD) within North and Central Stockton by 83 percent, with a residual EAD of approximately $63,000,000. The proposed project would have significant long-term effects on environmental resources, however in all

cases, the potential adverse environmental effects would be reduced to a less than significant level or mitigated through project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices. No jurisdictional wetlands were identified in the project footprint. Potential impacts to vegetation communities and special status species have been greatly reduced through feasibility level design. Direct impacts to nesting birds and other sensitive species would be avoided by implementing preconstruction surveys and scheduling of construction activities. The U.S. Fish & Wildlife Service and the National Marine Fisheries have provided a Biological Opinion in which the agency provided recommendations for design refinement or mitigation. The recommended plan would implement the environmental compensatory mitigation plan and associated monitoring and adaptive management plan.

4. Based on October 2017 price-levels, the estimated total first cost of the NED plan is $1,070,309,000. The federal share of the estimated first cost of initial construction is currently estimated at $695,701,000. The non-federal cost share for the NED plan is $374,608,000. The cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas is estimated at $189,101,000. The State of California, along with the San Joaquin Area Flood Control Agency would be responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project after construction. Operation and maintenance is currently estimated at about $1,062,000 per year.

5. Based on a 2.75-percent discount rate and a 50-year period of analysis, the total equivalent average annual costs of the project are estimated to be $49,294,000, including OMRR&R. The selected plan is estimated to be 89 percent reliable in reducing flood risk for the city of Stockton, California, from a flood which has a one percent chance of occurrence in any year. The selected plan would reduce average annual flood damages by about 83 percent and would leave average annual residual damages estimated at $63,000,000. Average annual economic benefits are estimated to be $345,024,000; net average annual benefits are $295,730,000. The benefit-to-cost ratio is 7.0 to 1.

6. The goals and objectives included in the Campaign Plan of the U.S. Army Corps of Engineers have been fully integrated into the Lower San Joaquin River feasibility study process. The recommended plan has been designed to avoid or minimize environmental impacts while maximizing future safety and economic benefits to the community. The Feasibility Study team organized and participated in stakeholder meetings and public workshops throughout the process and worked with local groups to achieve a balance of project goals and public concerns. The study report fully describes flood risks associated with the San Joaquin and Calaveras Rivers and describes the residual risk. The residual risks have been communicated to SJAFCA and the State of California, and they understand and agree with the analysis. Residual flood risk would be addressed through wise floodplain management measures such as a flood warning and emergency evacuation being incorporated into current plans.

7. In accordance with the Corps guidance on review of decision documents, all technical, engineering and scientific work underwent an open, dynamic and rigorous review process to ensure technical quality. This included District Quality Control (DQC) and Policy Certification,

Division Quality Assurance (DQA), Agency Technical Review (ATR), an Independent External Peer Review (IEPR) (Type I), and a Corps Headquarters policy and legal review. All concerns of the DQC and ATR have been addressed and incorporated into the final report. The Final IEPR Report was issued in May 8, 2015. Overall, a total of eight (8) comments were identified and documented and identified as having low significance. The IEPR comments focused on areas of the report consistency and clarity, plan formulation, economic evaluation, engineering assumptions, and environmental analyses. The IEPR panel comments and recommendations for resolution were concurred in and adopted. The IEPR process was completed in July 2015.

Overall the reviews from the aforementioned process resulted in report improvements. Incorporation of review recommendations resulted in expanded narratives and plan evaluations in plan formulation. Recommended improvements better support the decision-making process in the plan selection process. A safety assurance review (Type II IEPR) will be conducted during the design phase of the project.

8. Washington level review indicated that the project recommended by the reporting officers is technically sound, environmentally and socially acceptable, and economically justified. The plan complies with all essential elements of the 1983 U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Land Related Resources Implementation Studies. The recommended plan complies with other administrative and legislative policies and guidelines. The views of interested parties, including federal, state and local agencies have been considered.

9. I concur in the findings, conclusions, and recommendations of the reporting officers. I recommend that the Recommended Plan (Alternative 7a) be authorized for implementation, as a federal project, with such modifications thereof as in the discretion of the Chief of Engineers may be advisable. The plan includes fix-in-place improvements to the existing levees along Mosher Slough, Fourteenmile Slough, Tenmile Slough, the lower Calaveras River, San Joaquin River and French Camp Slough; the primary method of levee improvement is the construction of slurry walls of various depths. Also included are two closure structures and the construction of 0.75 miles of new levee. My recommendation is subject to cost sharing, financing, and other applicable requirements of federal and state laws and policies. The cost of the plan recommended in this Report will be cost shared in accordance with Section 103 of the WRDA 1986, as amended (33 U.S.C. 2213), with a minimum non-federal share of 35 percent, not to exceed 50 percent, of total NED costs. Applying these requirements, the federal portion of the estimated total first cost is $695,701,000 and the non-federal portion is $374,608,000, or a federal share of 65 percent and a non-federal share of 35 percent. Federal implementation of the selected plan would be subject to the non-federal sponsor agreeing to comply with applicable federal laws and policies, including but not limited to:

a. Provide a minimum of 35 percent, but not to exceed 50 percent, of NED Plan costs as further specified below:

1. Provide 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide, during construction, a contribution of funds equal to 5 percent of project costs which must be in the form of cash;

3. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of any relocations determined by the federal government to be required for the initial construction or the operation and maintenance of the project, all in compliance with applicable provisions of the Uniform Relocation and Assistance and real Property Acquisition Policies Act of 1970, as amended (42 U.S.C. 4601-4655) and the regulations contained in 49 C.F.R. Part 24;

4. Provide, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of project costs;

b. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the federal government, in a manner compatible with the project's authorized purposes and in accordance with applicable federal and state laws and regulations and any specific directions prescribed by the federal government;

c. Inform affected interests, at least annually, of the extent of protection afforded by the project; participate in and comply with applicable federal floodplain management and flood insurance programs; comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12); and publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

d. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) that might reduce the level of protection the project affords, hinder operation and maintenance of the project, or interfere with the project's proper function;

e. Give the federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-federal sponsors own or control for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

f. Hold and save the United States free from all damages arising from design, construction, operation, maintenance, repair, rehabilitation, and replacement of the project, except for damages due to the fault or negligence of the United States or its contractors;

g. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or

DAEN
SUBJECT: Lower San Joaquin River Feasibility Study Report, California

under lands, easements, or rights-of-way that the federal government determines to be required for construction, operation, and maintenance of the project. However, for lands that the federal government determines to be subject to the navigation servitude, only the federal government shall perform such investigations unless the federal government provides the non-federal sponsors with prior specific written direction, in which case the non-federal sponsors shall perform such investigations in accordance with such written direction;

h. Assume, as between the federal government and the non-federal sponsors, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the federal government determines to be required for construction, operation, and maintenance of the project; and

i. Agree, as between the federal government and the non-federal sponsors, that the non-federal sponsors shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA.

10. The recommendation contained herein reflects the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the states, interested federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

TODD T. SEMONITE
Lieutenant General, U.S. Army
Chief of Engineers

STRONGLY ENDORSE THIS PROJECT... BCR IS 7 to 1 CURRENT INTEREST RATE, BCR IS 2.6 @ 7% INTEREST RATE, VERY COMPETITIVE + VERY IMPORTANT!!

RECORD OF DECISION

LOWER SAN JOAQUIN RIVER BASIN
LOWER SAN JOAQUIN RIVER, CALIFORNIA
FLOOD RISK MANAGEMENT

The Final Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) dated 6 September 2017, for the Lower San Joaquin Feasibility Study addresses flood risk opportunities and feasibility in the Stockton, Lathrop, and Manteca, California. The final recommendation is contained in the report of the Chief of Engineers, dated 31 July 2018. Based on these reports, the reviews by other Federal, State, and local agencies, Tribes, input of the public, and the review by my staff, I find the plan recommended by the Chief of Engineers to be technically feasible, economically justified, in accordance with environmental statutes, and the public interest.

The Final IFR/EIS, incorporated herein by reference, evaluated various alternatives that would reduce flood risk along the Lower San Joaquin River, its tributaries, and sloughs in the study area. The recommended plan is the National Economic Development (NED) Plan and includes:

Delta Front

- 3.05 miles of fix in place improvements with soil-bentonite cutoff walls of various depths with 2.5 miles of geometry improvement.
- 1.1 miles of seismic fixes through deep soil mixing in North Stockton along two segments of Tenmile Slough.
- 1.33 miles of new setback levee along the Delta Front to eliminate the eastern portions of the Fourteenmile Slough levee in North Stockton.
- 0.59 miles of height improvements between 1.8 and 2.7 feet on the Delta Front.
- 5 miles of erosion protection.
- Control Structure on Fourteenmile Slough.

North Stockton

- 9.4 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in North Stockton.
- 2.03 miles of height improvements between 1.4 and 1.6 feet in North Stockton.

Central Stockton

- 9.2 miles of fix in place improvements with soil bentonite cutoff walls of various depths in Central Stockton.
- 2 miles of levee geometry improvements in Central Stockton along one segment of the Calaveras River and one segment of the San Joaquin River.
- 0.53 miles of height improvements of 1.8 feet in Central Stockton.
- 0.75 miles of new levee with soil-bentonite cutoff wall on Duck Creek to address flanking of flood waters from south of Central Stockton.
- 0.28 miles of height improvements of 4 feet on the RD 404 levee.
- Control Structure at Smith Canal with 0.2 miles of floodwall.
- Implementation of the environmental compensatory mitigation and associated monitoring and adaptive management plan. Monitoring will continue until the mitigation is determined to be successful based on the identified criteria within the Habitat Mitigation, Monitoring, and Adaptive Management Plan included in the Environmental Addendum. Monitoring is expected to last no more than 5 years.

ENCL 2

In addition to a "no action" plan, six alternatives were evaluated. The alternatives included Alternative 7a, the recommended plan, which includes measures to improve levees, measures to construct new levees, and measures to reduce flood risk through in-water control structures; Alternative 7b included the same measures as are included in the recommended plan but also included measures to improve levees in RD 17; Alternative 8a included the same measures as Alternative 7a but also included additional measures to improve levees along a greater extent of RD 17; Alternative 8a included the same measures as Alternative 7a, but also included measures to improve levees along a greater extent of the Calaveras River and also on the Stockton Diverting Canal; Alternative 8b included the same measures as Alternative 8a in North and Central Stockton and the same measures as Alternative 7b in RD 17; Alternative 9a, included the same measures as Alternative 7a but with the addition of measures to construct a flood bypass through Old Mormon Slough and divert some flood waters into this bypass; and, Alternative 9b included the same measures as Alternative 9a in North and Central Stockton and the same measures as Alternative 7b in RD 17. Several other structural and non-structural alternatives were considered but were eliminated due to greater cost relative to benefits, adverse environmental effects, and/or inconsistency with policy. The recommended plan was identified as the environmentally preferable alternative.

For all alternatives, the potential effects to the following resources were evaluated:

	In-depth evaluation conducted	Brief evaluation due to minor effects	Resource unaffected by action
Aesthetics	☒	☐	☐
Air quality	☒	☐	☐
Aquatic resources/wetlands	☒	☐	☐
Invasive species	☐	☒	☐
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species	☒	☐	☐
Historic properties	☒	☐	☐
Other cultural resources	☐	☐	☒
Floodplains	☒	☐	☐
Hazardous, toxic & radioactive waste	☐	☐	☒
Hydrology	☒	☐	☐
Land use	☒	☐	☐
Navigation	☐	☒	☐
Noise levels	☒	☐	☐
Public infrastructure	☒	☐	☐
Socio-economics	☒	☐	☐
Environmental justice	☒	☐	☐
Soils	☐	☐	☒
Tribal trust resources	☐	☐	☒
Water quality	☐	☒	☐
Climate change	☐	☒	☐
Transportation	☒	☐	☐
Recreation	☒	☐	☐

All practical means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the IFR/EIS (Sections 5.5, 5.9, and 5.10) will be implemented to minimize impacts. A conservative approach was used to quantify impacts to ensure that all potential unavoidable effects were identified. If the project is authorized and funded by Congress, the effects analysis would be further refined based upon detailed engineering analyses and biological surveys. These refinements are expected to reduce impacts.

The recommended plan will result in unavoidable adverse impacts to 10.75 acres of wetland habitat, 139 acres of woody riparian habitat, 41 elderberry shrubs typically used by the valley elderberry longhorn beetle, 19,630 linear feet (LF) of shaded riverine aquatic habitat typically used by the giant garter snake (GGS), up to 4 acres of open water habitat typically used by Delta smelt (designated critical habitat), temporary recurring impact on 234 acres of shallow water habitat typically used by Delta smelt, 111.5 acres of upland habitat, and 6 acres of aquatic habitat used by the GGS. To mitigate for these unavoidable adverse impacts, the U.S. Army Corps of Engineers will purchase credits at an approved mitigation bank equivalent to restoring habitat to up to 7.68 acres of wetland, 2 acres of open water habitat, 72.13 acres of woody riparian habitat, 123 acres of shallow water habitat, 58,890 LF of shaded riverine aquatic habitat, 35.12 acres of upland GGS habitat, and 1.5 acres of aquatic GGS habitat. Temporary impacts to upland and aquatic GGS habitat will be mitigated through on-site restoration through hydroseeding and the relocation and reestablishment of affected drainage ditches. Permanent impacts on elderberries will be mitigated through the creation of 14 acres of on-site habitat. Shrubs in the footprint will be transplanted to the conservation area and additional elderberry and associated native plants will be planted.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Fish and Wildlife Service (FWS) issued a biological opinion, dated 13 June 2016, that determined that the recommended plan will not jeopardize the continued existence of the following federally listed species or adversely modify designated critical habitat: Delta Smelt, Giant Garter Snake, and Valley Elderberry Longhorn Beetle. All terms and conditions, conservation measures, and reasonable and prudent alternatives and measures resulting from these consultations shall be implemented in order to minimize take of endangered species and avoid jeopardizing the species.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the National Marine Fisheries Service (NMFS) issued a biological opinion, dated 7 June 2016, that determined that the recommended plan will not jeopardize the continued existence of the following federally listed species or adversely modify designated critical habitat: CV spring-run Chinook salmon, California CV steelhead, Southern DPS of North American green sturgeon, and Pacific Coast Salmon. All terms and conditions, conservation measures, and reasonable and prudent alternatives and measures resulting from these consultations shall be implemented in order to minimize take of endangered species and avoid jeopardizing the species.

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that historic properties may be adversely affected by the recommended plan. The Corps and the California State Historic Preservation Office entered into a Programmatic Agreement (PA), dated 11 May 2016. All terms and conditions resulting from the agreement shall be implemented in order to minimize adverse impacts to historic properties.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section

404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Environmental Addendum D of the IFR/EIS.

A water quality certification pursuant to section 401 of the Clean Water Act will obtained from the California Central Valley Regional Water Quality Regional Water Quality Control Board (RWQCB) prior to construction. In a letter dated 29 April 2016, the RWQCB stated that the recommended plan appears to meet the requirements of the water quality certification, pending confirmation based on information to be developed during the pre-construction engineering and design phase. All conditions of the water quality certification will be implemented in order to minimize adverse impacts to water quality.

In compliance with the Clean Air Act of 1963, as amended, the Corps will avoid and minimize impacts to air quality with the implementation of best management practices, including implementation of the San Joaquin Metropolitan Air Quality Management District's Basic Construction Emission Control Practices and the use of on-road hauling equipment manufactured 2010 or later. The Corps will coordinate with San Joaquin County Public Works Department, City of Stockton Department of Community Services and the Department of Public Works, local recreation users, boating and bike groups, implement best management practices for safety, such as flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites during construction, and restore recreation facilities directly impacted to pre-project conditions following construction to reduce significant impacts to recreation, except at Dad's point, where a floodwall will permanently alter this recreation area.

Public review of the draft IFR/EIS was completed on 8 April 2015. All comments submitted during the public comment period were responded to in the Final IFR/EIS. A 30-day waiting period and state and agency review of the Final IFR/EIS was completed on 5 March 2018. Comments from state and Federal agency review did not result in any changes to the final IFR/EIS.

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on the review of these evaluations, I find that benefits of the recommended plan outweigh the costs and any adverse effects. This Record of Decision completes the National Environmental Policy Act process.

Feb 8, 2019
Date

R.D. James
Assistant Secretary of the Army
(Civil Works)

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

January 28, 2019

The Honorable R.D. James
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310-0108

Dear Mr. James:

As required by Executive Order 12322, the Office of Management and Budget has reviewed a January 2018 Army Corps of Engineers (Corps) interim feasibility report (report) on the Lower San Joaquin River, which recommends a series of levee system improvements to reduce flood risks in Stockton, California. This report estimates that this project would have a first cost of $1.070 billion ($696 million Federal) at the October 2017 price levels. The America's Water Infrastructure Act of 2018 authorized the Corps to construct this project. Based on the Corps estimate of the benefits and the cost, we have concluded that this project is consistent with the policy and programs of the President.

The Corps report estimates that the benefit-cost ratio (BCR) for the project is 7.0 to 1 at a 2.75% discount rate. This is the discount rate for Fiscal Year 2018 under section 80 of the Water Resources Development Act of 1974. According to the Corps, the equivalent BCR is 2.6 to 1 at a 7% discount rate. The Executive Branch uses this discount rate to measure the performance of projects like this one, whose primary purpose is to provide an economic return to the Nation.

The Office of Management and Budget does not object to your submitting this report to the Congress. When you do so, please advise the Congress that this project, like all other Corps projects, will need to compete with other proposed investments in future Budgets.

Sincerely,

John Pasquantino
Deputy Associate Director
Energy, Science, and Water

ENCL 3

State and Agency Review

State and Agency review, as required by the Flood Control Act of 1944, as amended, was conducted for the proposed Chief's Report. Two letters, one from the Environmental Protection Agency (EPA) and one from U.S. Geological Survey (USGS), were received during this process.

The EPA re-iterated their concerns from the DEIS which related to wetland identification, levee vegetation variance and air quality emissions. Both the EPA and the Corps agree that these will be ongoing issues to track during PED and construction phases. The issues will be mentioned in the ROD.

The USGS concerns relates to an existing stream gage in the watershed which were not identified in the FEIS and for which the agency would like commitment to safeguard this gage during PED and construction to ensure it remains an operational data source for the Central Valley. A statement to this effect will be places in the ROD.

ENCL4

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

JUL 3 1 2018

Ms. Kathleen Martyn Goforth, Manager
Environmental Review Office (ENF 4-2)
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105-3918

Dear Ms. Goforth:

This letter is in response to your comments on the Final Integrated Interim Feasibility Report and Joint Environmental Impact Statement/Environmental Impact Report (Final Report) for the Lower San Joaquin River Basin, Lower San Joaquin River, CA feasibility study. Your comments were provided in a letter dated March 12, 2018.

We have addressed your comments concerning the project's mitigation strategy for air quality effects on nitrogen oxide (NO) and nitrogen dioxide (NO_2), together referred to as NOx, in the Record of Decision (ROD). The ROD clarifies that on-site mitigation measures will be used to the extent feasible to mitigate NOx with purchase of emissions offsets being used only if on-site mitigation is not feasible. As discussed in your letter, the Corps will identify delineated boundaries of wetlands and waters of the U.S. in more detail in subsequent project phases. We will also keep EPA apprised about the analyses supporting the levee vegetation decision for this project. These issues will be in our eventual ROD for the project.

If you would like to discuss this further, please contact Mr. Bradd Schwichtenberg, Deputy Chief, South Pacific Division Regional Integration Team, Headquarters, (202) 761-1367 or by email at bradd.r.schwichtenberg@usace.army.mil.

Sincerely,

Joseph H. Redican
Acting Chief, Planning and Policy Division
Directorate of Civil Works
U.S. Army Corps of Engineers

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

March 12, 2018

Charles Wilson
U.S. Army Corps of Engineers
ATTN: CECW-P (IP)
7701 Telegraph Road
Alexandria, Virginia 22315-3860

Subject: Lower San Joaquin River Project Final Integrated Interim Feasibility Report / Environmental Impact Statement / Environmental Impact Report (EIS No. 20180011)

Dear Mr. Wilson:

The U.S. Environmental Protection Agency (EPA) has reviewed the Lower San Joaquin River Project Final Integrated Interim Feasibility Report / Environmental Impact Statement / Environmental Impact Report (FEIS) pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

EPA reviewed the Draft Environmental Impact Statement (DEIS) and provided comments to the U.S. Army Corps of Engineers (USACE) on April 27, 2015. We rated the DEIS as Environmental Concerns - Insufficient Information (EC-2) due to concerns regarding potential impacts to water quality and wetlands, and opportunities to reduce impacts to air quality. We appreciate the inclusion in the FEIS of additional information about water quality impairments and USACE's coordination with the Regional Water Quality Control Board, U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the California Department of Fish and Wildlife to limit impacts on water quality and aquatic resources. We understand that USACE will complete a formal wetland delineation prior to project construction and we appreciate the additional information in the FEIS regarding how the project would address significant differences between the assumptions in the EIS and the final delineation.

The FEIS includes additional information about the process for obtaining a variance from the USACE vegetation removal policy, and estimates that 50% of the existing vegetation on the lower waterside slope and within the waterside easement may be allowed to remain, based on currently available information and engineering judgment (page 4-38). We understand that an additional engineering evaluation during the design phase will determine the levees' suitability for a variance. EPA continues to strongly support the application for such a variance to preserve important habitat functions and water quality in the study area.

The response to comments states that EPA's suggestions for further reducing oxides of nitrogen (NOx) emissions are not necessary because the EIS already provides mitigation to reduce emissions to less than significant levels. Please note that the focus of EPA's recommendation, which acknowledged the

USACE's intent to mitigate NOx emissions to less than significant levels, was on prioritization of the measures to be employed in achieving such reduction. The referenced mitigation includes the option of funding off-site mitigation through the purchase of emission offsets, rather than committing to feasible on-site mitigation measures. We recommended, and continue to recommend, prioritizing on-site mitigation measures, such as the use of Tier 4 equipment for all off-road vehicles, limiting idling, and other measures identified in our comments on the DEIS, to reduce emissions before relying on the purchase of regional offsets.

Thank you for the opportunity to review the FEIR/EIS. If you have any questions, please contact me at 415-972-3521, or contact Jean Prijatel, the lead reviewer for this project, at 415-947-4167 or prijatel.jean@epa.gov.

Sincerely,

Kathleen Martyn Goforth, Manager
Environmental Review Section

cc: Tanis Toland, USACE Sacramento District

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

JUL 3 1 2018

Ms. Michaela Noble
Director, Office of Environmental Policy and Compliance
U.S. Department of the Interior
1849 C Street, NW – MS 5538 – MIB
Washington, D.C. 20240

Dear Ms. Noble:

This letter is in response to comments provided by the U.S. Department of the Interior on the draft Chief's Report and Final Integrated Interim Feasibility Report and Joint Environmental Impact Statement/Environmental Impact Report (Final Report) for the Lower San Joaquin River Basin, Lower San Joaquin River, CA feasibility study. The comments were submitted by the U.S. Geological Survey (USGS) and provided in a letter dated March 12, 2018.

In the letter, USGS makes three requests. First, the USGS requests that potential levee construction impacts to streamgage 11304810 (San Joaquin below Garwood Bridge Stockton), alterations to river hydraulics, and coordination with the USGS be discussed within the Final Environmental Impact Statement (FEIS). Second, the USGS requests that the FEIS and Record of Decision (ROD) list streamgages as sites to be safeguarded throughout construction and that USGS California Water Science Center in Sacramento be contacted and given sufficient advance notice before construction begins near active USGS streamgages to ensure that streamgages are preserved and impacts to the data integrity collected at those sites are avoided or minimized. Finally, USGS comments that alterations to river hydraulics such as levee construction and channel modifications impact the USGS calculations of flow at streamgages and requests the design and final as-built channel and overbank geometries be shared with the USGS.

We have addressed these comments in the ROD. The ROD states that the USGS San Joaquin River at Garwood gage (11304810) may be affected by project construction and may be temporarily relocated during construction of the levee improvements. It further states that the temporary impacts would be coordinated with USGS during the preconstruction engineering and design (PED) phase if the project is authorized and funded by Congress. The project is anticipated to have no impact on the channel hydraulics that would need to be accounted for by the USGS. In the ROD, we commit to additional coordination with the USGS California Water Science Center regarding project details, including plans.

If you would like to discuss this further, please contact Mr. Bradd Schwichtenberg, Deputy Chief, South Pacific Division Regional Integration Team, Headquarters, (202) 761-1367 or by email at bradd.r.schwichtenberg@usace.army.mil.

Sincerely,

Joseph H. Redican
Acting Chief, Planning and Policy Division
Directorate of Civil Works
U.S. Army Corps of Engineers

Copy Furnish:
J. Micheal Norris, USGS, mnorris@usgs.gov

United States Department of the Interior

Office of the Secretary
Office of Environmental Policy and Compliance
1849 C Street, NW - MS 5538 - MIB
Washington, D.C. 20240

MAR 12 2018

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PEP/NRM

ER 15/0126

Ms. Noel Clay
Acting Chief, Planning and Policy Division
Directorate of Civil Works
U.S. Army Corps of Engineers
CECW-P (SA)
7701 Telegraph Road
Alexandria, VA 22315-3860

Re: Lower San Joaquin Project – Draft Chief of Engineers Report and Final Environmental Impact Statement

Dear Ms. Clay:

The Department of the Interior (Department) has reviewed the Draft Chief of Engineers Report and Final Environmental Impact Statement (FEIS) regarding the Lower San Joaquin Project in San Joaquin County, California. The Department submits the following comments from the U.S. Geological Survey (USGS) regarding USGS streamgage instrumentation and measurements in the proximity of the proposed project as well as available USGS science information on subsidence, groundwater and seepage.

USGS streamgages on the Lower San Joaquin River

The USGS operates streamgages throughout the United States to collect water quantity and quality data for a variety of purposes. Continuous operation of the USGS streamgages is essential for our stakeholders. These sites often have permanent infrastructure and are vulnerable to disruption when nearby construction occurs in the vicinity of these streamgages. The locations of some active USGS streamgages are discussed within the FEIS including the Vernalis and Newman locations; however, one streamgage, 11304810, San Joaquin below Garwood Bridge Stockton, is not discussed and may potentially be impacted by the proposed project construction. The USGS requests that potential levee construction impacts to this streamgage, alterations to river hydraulics, and coordination with the USGS be discussed within the FEIS.

The USGS requests that the FEIS and Record of Decision (ROD) list streamgages as sites to be safeguarded throughout construction and that the USGS California Water Science Center in Sacramento be contacted and given sufficient advance notice before construction begins near active USGS streamgages to ensure that streamgages are preserved and impacts to the data

integrity collected at those sites is minimized. Additionally, alterations to river hydraulics such as levee construction and channel modifications impact the USGS calculations of flow at streamgages and the USGS requests the design and final as-built channel and overbank geometries are shared with the USGS.

USGS and San Joaquin River Restoration Program Data and Publications

The USGS has published information about subsidence within the San Joaquin Valley that could be valuable to this project, available at https://pubs.er.usgs.gov/publication/70161815. Additionally, the USGS has long been involved with San Joaquin River Restoration project work including groundwater and seepage analyses, available at http://www.restoresjr.net/science/reports/.

If there are any comments, please contact J. Michael Norris of USGS at mnorris@usgs.gov. Thank you for the opportunity to review and comment on this project.

Sincerely,

Michaela Noble

Michaela E. Noble
Director, Office of Environmental Policy
and Compliance

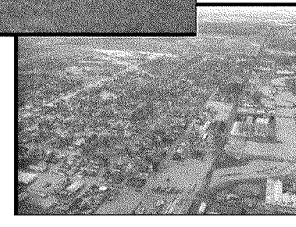
Electronic distribution: Scott Nicholson, scott.r.nicholson@usace.army.mil

cc: Janet Whitlock, REO San Francisco, janet_whitlock@ios.doi.gov
Patricia Bee, USACE, patricia.l.bee@usace.army.mil
J. Michael Norris, USGS, mnorris@usgs.gov

TRANSMITTED ELECTRONICALLY – NO HARD COPY TO FOLLOW

January 2018

San Joaquin River Basin
Lower San Joaquin River, CA
FINAL
Integrated Interim Feasibility Report/ Environmental Impact Statement/ Environmental Impact Report



SJAFCA
San Joaquin Area FLOOD CONTROL Agency

US Army Corps of Engineers®
Sacramento District

LOWER SAN JOAQUIN RIVER PROJECT INTERIM REPORT

SAN JOAQUIN COUNTY, CALIFORNIA

FINAL

INTEGRATED INTERIM FEASIBILITY REPORT/ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

JANUARY 2018

Type of Statement: Final Integrated Feasibility Report/Environmental Impact Statement/Environmental Impact Report (FR/EIS/EIR)

Lead NEPA Agency: U.S. Army Corps of Engineers, Sacramento District

Lead CEQA Agency: San Joaquin Area Flood Control Agency

Cooperating/Responsible Agency: State of California Central Valley Flood Protection Board

Abstract: The U.S. Army Corps of Engineers and its non-Federal sponsors, the San Joaquin Area Flood Control Agency and the State of California Central Valley Flood Protection Board, propose to improve flood risk management in North and Central Stockton by repairing and enhancing the levees that surround the city, and by constructing and operating closure structures on Fourteenmile Slough and Smith Canal. The final FR/EIS/EIR describes the environmental resources in the project area; evaluates the direct, indirect, and cumulative environmental effects of the seven alternative plans, including the Recommended Plan (preferred alternative); and identifies avoidance, minimization, and compensatory mitigation measures. Most potential adverse effects would either be short term, or would be avoided or reduced using best management practices. However, there are some significant and unavoidable impacts associated with this project.

Public Review and Comment: The public review period for the draft FR/EIS/EIR began on February 27, 2015, and the official closing date for receipt of comments was April 13, 2015. All comments received were considered and incorporated into the final FS/EIS/EIR, as appropriate. The public review period for the final FR/EIS/EIR will begin when the notice of availability is published in the Federal Register on February 9, 2018, and will close 30 days later. Written comments or questions concerning this document should be directed to the following: Headquarters, U.S. Army Corps of Engineers, ATTN: CECW-P (IP), 7701 Telegraph Road, Alexandria, VA 22315-3860 or San Joaquin Area Flood Control Agency; Attn: Mr. Juan Neira, 22 East Weber Avenue, Suite 301, Stockton, California 95202-2317, or by email at Juan.Neira@stocktongov.com.

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A. ECONOMICS ADDENDA

B. ENGINEERING ADDENDA

C. REAL ESTATE ADDENDA

D. ENVIRONMENTAL ADDENDA

E. GEOTECHNICAL ADDENDA

F. HYDRAULICS ADDENDA

G. HYDROLOGY ADDENDA

H. COST ENGINEERING ADDENDA

I. PLAN FORMULATION ADDENDA

*All documents can be found on http://www.spk.usace.army.mil/lower_sj_river

LIST OF ACRONYMS

AADT	Annual Average Daily Traffic
AB	Assembly Bill
ACE	Annual Chance of Exceedance
AEP	Annual Exceedance Probability
ATR	Agency Technical Review
BA	Biological Assessment
BDCP	Bay Delta Conservation Plan
BMP(s)	Best Management Practice(s)
BNSF	Burlington Northern Santa Fe Railroad
BO	Biological Opinion
BSC	Building Standards Commission
BSSCP	Bentonite Slurry Spill Contingency Plan
CAA	Clean Air Act
CAR	Coordination Act Report
CARB	California Air Resources Board
CCR	California Code of Regulations
CCT	Central California Traction Company
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH4	Methane
CLD	California Levee Database
CLSP	Central Lathrop Specific Plan
CMP	Congestion Management Program
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO^2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CRHR	California Register of Historical Resources
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
cy	cubic yards
dB	decibel
dBA	Weighted decibel
DDT	dichlorodiphenyltrichloroethane
DEIS/DEIR	Draft Environmental Impact Statement/Draft Environmental Impact Report
Delta	Sacramento-San Joaquin Delta
DO	dissolved oxygen
DPM	Diesel Particulate Matter
DPS	Distinct Population Segment
DSC	Delta Stewardship Council
DSM	DEEP Soil Mixing

DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
DWSC	Deep Water Ship Channel
DWSP	Delta Water Supply Project
EO	Executive Order
EC	electrical conductivity
EC	Engineer Circular
EFH	Essential Fish Habitat
EMT	Emergency Medical Trained
EOPs	Environmental Operating Principles
EQ	Environmental Equality
ER	Ecosystem Restoration
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ETL	Engineer Technical Letter
FCSA	Feasibility Cost Sharing Agreement
FEMA	Federal Emergency Management Agency
FPPA	Farmland Protection Policy Act
FR	Federal Register
FR/EIS/EIR	Feasibility Report/Environmental Impact Statement/Environmental Impact Report
FRM	Flood Risk Management
FSZ	Farmland Security Zone
ft	feet
FTA	Federal Transit Administration
FWCA	Fish and Wildlife Coordination Act
FWEEP	Flood Warning, Emergency Evacuation Plan
FWOP	Future Without Project
GCR	General Conformity Rule
GGS	Giant Garter Snake
GHG	Greenhouse Gas
gpm	gallons per minute
GWP	Global Warming Potential
HABS	Historic American Building Survey
HFCs	Hydrofluorocarbons
HFEs	Hydrofluorinated ethers
HPTPs	Historic Property Treatment Plans
HTRW	Hazardous, Toxic and Radioactive Waste
IEPR	Independent External Peer Review
LAFCO	Local Agency Formation Commission
Ldn	level of day-night sound
LERRDs	Lands, Easements, Rights of Way, Relocations, and Disposal Sites
LESA	Land Evaluation and Site Assessment
lf	Linear Feet
LOS	Level of Service
LPP	Locally Preferred Plan
LSAP	Levee Seepage Area Project
LSJR	Lower San Joaquin River
LSJRFS	Lower San Joaquin River Feasibility Study
MBTA	Migratory Bird Treaty Act
MCACES	Micro Computer-Aided Cost Engineering System
MCL	Maximum Contaminant Levels
mgd	million gallons per day
N_2O	Nitrous oxide

NAAQS	National Ambient Air Quality Standards
NAD 83	North American Horizontal Datum of 1983
NED	National Economic Development
NEPA	National Environmental Policy Act
NF3	Nitrogen trifluoride
NFIP	National Flood Insurance Program
NFS	non-Federal Sponsors
NH_4	ammonium
NHPA	National Historic Preservation Act
NLD	National Levee Database
NMFS	National Marine Fisheries Service
NO^2	nitrite
NO^3	nitrate
NOI	Notice of Intent
NOP	Notice of Preparation
NOx	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSAS-HD	Naval Supply Annex Stockton Historic District
NULE	Non-Urban Levee Evaluation
NWI	National Wetland Inventory
O&M	Operations and Maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
OPR	Office of Planning and Research
OSE	Other Social Effects or Social Wellbeing
PA	Programmatic Agreement
PCBs	polychlorinated biphenyls
PCET	Parametric Cost Estimation Tool
PED	Preconstruction Engineering and Design
PFCs	perfluorocarbons
PL	Public Law
PM10	Respirable Particulate Matter
PM2.5	Fine Particulate Matter
PPA	Project Partnership Agreement
ppm	Parts per Million
ppt	Parts per thousand
PRC	Public Resource Code
R&U	Risk and Uncertainty
RCEM	Road Construction Emission Model
RDEIR/SDEIS	Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement
RED	Regional Economic Development
rkm	River kilometer
ROG	Reactive organic gases
RP	Recommended Plan
RWCF	Regional Wastewater Control Facility
RWQCB	Regional Water Quality Control Board
SB 5	Senate Bill 5
SDC	Stockton Diverting Canal
SEWD	Stockton East Water District
SF6	Sulfur hexafluoride

SHPO	State Historic Preservation Office
SIPs	State Implementation Plans
SJAFCA	San Joaquin Area Flood Control Agency
SJCOG	San Joaquin Council of Governments
SJMSCP	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
SJR	San Joaquin River
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SLC	Sea Level Change
SMARA	Surface Mining and Reclamation Act
SMGB	State Mining and Geology Board
SOI	Sphere of Influence
SPCCP	Spill Prevention, Control and Counter Measure Plan
SPD	South Pacific Division
SPFC	State Plan of Flood Control
SPRR	Southern Pacific Railroad
sq ft	Square feet
SRA	Shaded Riverine Aquatic
STE	Stockton Terminal and Eastern Railroad
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminants
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSP	Tentatively Selected Plan
TWAE	Temporary Work Area Easements
ULDC	Urban Levee Design Criteria
ULE	Urban Levee Evaluation
ULOP	Urban Level of Protection
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USBR	United States Bureau of Reclamation
USC	U.S. Code
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VdB	Vibration decibels
VELB	valley elderberry longhorn beetle
VERA	Verified Emission Reduction Agreement
VFZ	Vegetation Free Zone
WRDA	Water Resources Development Act

EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

The purpose of the Lower San Joaquin River Feasibility Study is to identify a cost-effective plan to reduce flood risk in the Stockton metropolitan area. An unacceptably high risk of flooding from levee failure threatens the safety of 235,000 people, as well as property and critical infrastructure throughout the area.

This integrated Interim Feasibility Report and joint Environmental Impact Statement/Environmental Impact Report (FR/EIS/EIR) describes the planning process followed to develop and evaluate an array of alternatives and identify the Recommended Plan (RP), which is also the Preferred Alternative under the National Environmental Policy Act (NEPA), to address flood risk management problems and opportunities in the Lower San Joaquin River (LSJR) basin. The RP identified in this study is also the Environmentally Preferable Alternative under NEPA and the Least Environmentally Damaging Practicable Alternative under the Clean Water Act. The U.S. Army Corps of Engineers, Sacramento District (USACE), the San Joaquin Area Flood Control Agency (SJAFCA), the State of California, represented by the Central Valley Flood Protection Board (CVFPB) and the Department of Water Resources (DWR) are sponsoring this study. This FR/EIS/EIR meets the environmental impact assessment and disclosure requirements of NEPA and the California Environmental Quality Act (CEQA). USACE is the lead agency under NEPA. SJAFCA is the lead agency under CEQA. CVFPB and DWR are cooperating agencies under NEPA and Responsible Agencies under CEQA.

The Draft FR/EIS/EIR was released for concurrent public review, internal policy review, Agency Technical Review (ATR) and Independent External Peer Review (IEPR). All comments received during the ATR, IEPR and the 45-day public review period were considered and incorporated into the Final FR/EIS/EIR, as appropriate. The Final FR/EIS/EIR presents the RP for potential authorization by Congress.

STUDY AREA

The LSJR Study area (Figure ES-1) is located along the northern portion of the San Joaquin River system in the Central Valley of California. The San Joaquin River originates on the western slope of the Sierra Nevada and emerges from the foothills at Friant Dam. The river flows west to the Central Valley, where it is joined by the Fresno, Chowchilla, Merced, Tuolumne, Stanislaus and Calaveras Rivers, and joined by smaller tributaries as it flows north to the Sacramento-San Joaquin Delta (Delta).

The overall study area, as defined in the study authorization, includes the mainstem of the San Joaquin River from the Mariposa Bypass downstream to the city of Stockton. The study area also includes the distributary channels of the San Joaquin River in the southernmost reaches of the Delta; Paradise Cut and Old River as far north as Tracy Boulevard, and Middle River as far north as Victoria Canal. Based on availability of potential non_Federal sponsors (NFS), the refined study area focused on approximately 305 square miles encompassing incorporated areas of Stockton, Lathrop and Manteca, as well as unincorporated portions of San Joaquin County. During the plan formulation process, approximately 15,000 acres of urban, urbanizing and agricultural lands were screened out due to lack of Federal interest. The screening was consistent with Executive Order 11988, Floodplain Management. The remaining study area was divided into three separable elements considered to be hydraulically separate, meaning that each area could have stand-alone solutions or alternatives proposed.

This study will only partially address the Sacramento – San Joaquin Basin Streams, California Comprehensive Study authority. Therefore, the Lower San Joaquin Feasibility Study (LSJRFS) report will be called an "Interim Feasibility Report", which indicates that the study is addressing the flood risk issues of a specific area within the authority, rather than the entire area authorized for study. This does not rule out additional studies for this or other areas within the authorized study area at a future date.

BACKGROUND AND NEED

Study Authority

The general authority for flood control investigations in the San Joaquin River Basin arises under the Flood Control Act of 1936 (Public Law [PL] 74-738), Sections 2 and 6, and amended by the Flood Control Act of 1938 (PL 75-761). Further studies of this river system were requested in the May 8, 1964 resolution adopted by the Committee on Public Works of the House of Representatives.

Study Background

USACE initiated the Feasibility Study in 2009 at the request of SJAFCA, the NFS for the study, through the execution of a Feasibility Cost Sharing Agreement (FCSA). CVFPB also entered the study as a signatory of the FCSA in 2010.

The study area has a history of flood events, with major floods occurring in 1955, 1958, and 1997. The 1955 event had the highest flows recorded on the Calaveras River at Bellota, and approximately 1,500 acres of Stockton were inundated to depths of 6 feet for as long as 8 days. The 1958 event inundated approximately 8,500 acres between Bellota and the Diverting Canal, with flood waters up to 2 feet deep and inundation durations from 2 to 10 days. The 1955 and 1958 floods occurred prior to completion of New Hogan Dam and Reservoir and improvements to the Calaveras River and Stockton Diverting Canal. The 1997 event resulted in the evacuation of the Weston Ranch area of Stockton at the north end of Reclamation District 17 (RD 17). While the 1997 event did not directly damage areas of Stockton, Lathrop or Manteca, there were approximately 1,842 residences and businesses affected in San Joaquin County. There were also significant flood-fighting efforts conducted during the 1997 event in RDs 404 and 17. Between the 2 RDs, flood-fights were required at 37 sites. Of interest to this study were breaches upstream of RD 17 along the San Joaquin and Stanislaus Rivers, resulting in the non-Federal tieback levee being highly stressed, but preventing flooding of urban areas in RD 17 and potentially central Stockton. Estimated damages in San Joaquin County for the 1997 event were approximately $80 million.

Analysis of the study area is challenged by the presence of three sources of flooding, the Delta Front, Calaveras River and San Joaquin River. This results in commingled floodplains for the North and Central Stockton areas. The distributary nature of the Delta also affects Delta water levels, because high flows from the Sacramento River may "fill" the Delta prior to a peak inflow on the San Joaquin River as occurred in 1997, raising water levels on the Delta front levees.

The existing levee system within the project area provides flood risk management (FRM) benefits to over 71,000 acres of mixed-use land with a current population estimated at 235,000 residents and an estimated $28.7 billion in damageable property. Further, as the floodplain habitat was altered, native functional habitats were lost, causing impacts to endangered and threatened species. In addition, the levees along the San Joaquin River effectively cut off direct public access to the river and its associated environmental and recreational amenities in many areas.

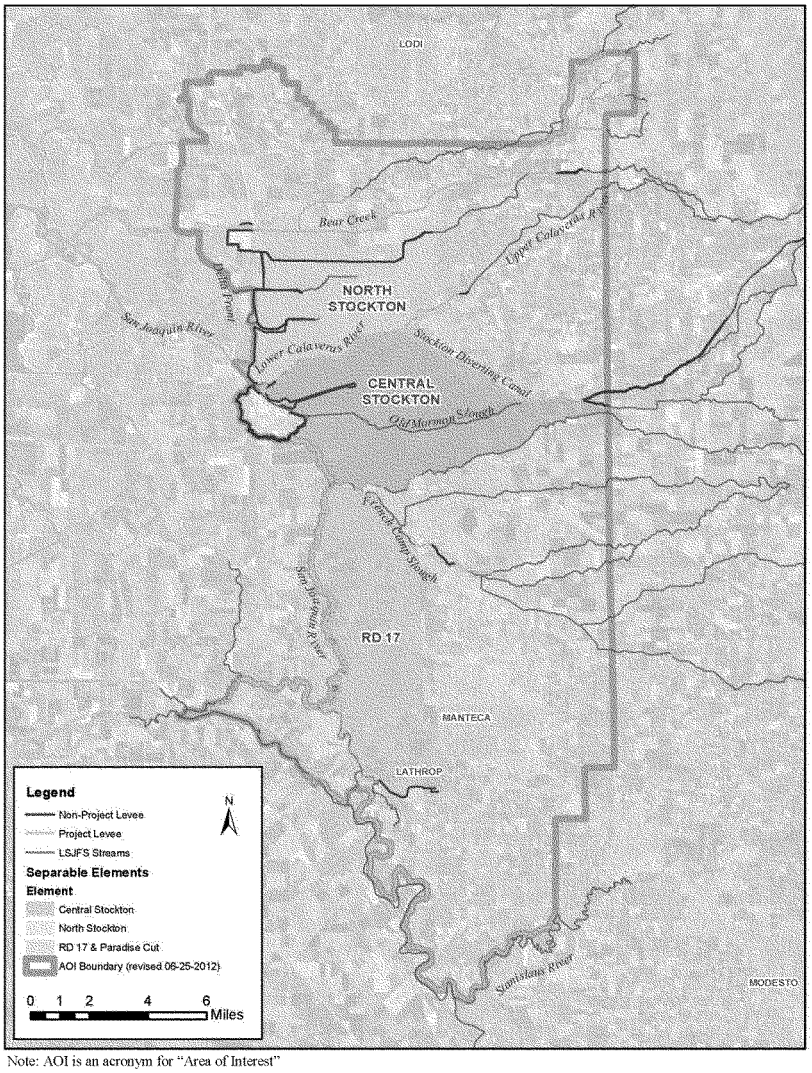
The problems and opportunities in the Stockton area include:

Problem:

- There is significant risk to public health, safety and property in the study area associated with flooding.

Opportunities:

- Improve FRM in the study area.
- Sustain and improve aquatic, riparian and adjacent terrestrial habitats in conjunction with FRM features.
- Integrate with other Federal, State and local initiatives.
- Educate the public about residual flood risk.



Note: AOI is an acronym for "Area of Interest"

Figure ES-1: The LSJR Study Area

CONSIDERATION OF ALTERNATIVE PLANS

During the feasibility study, the Federal planning process for development of water resource projects was followed to identify a RP for recommendation to Congress. Following definition of flood related problems and opportunities, specific planning objectives and planning constraints were identified. Various management measures were identified to achieve the planning objectives and avoid constraints. Management measures were combined to form an array of FRM alternative plans, which were developed on the basis of the north and central Stockton, and RD 17 areas being hydraulically separable.

The strategy to move the initial array of alternatives forward to a focused array of alternatives included the following steps: (1) apply metrics to evaluate alternative arrays; (2) select the best alternative for each separable area or levee reach based on a parametric cost and benefit analysis; and (3) combine the best alternatives to be carried forward to the focused array. After additional analysis of the focused array of alternatives, it was determined that addressing potential sea level change during the period of analysis was economically justified and provided improved performance. This resulted in removing three alternatives from further consideration. The Final alternative plans were then compared to identify the plan that reasonably maximized net National Economic Development (NED) benefits consistent with protecting the Nation's environment. The NED plan is also the RP.

ALTERNATIVES

The alternatives described in the Draft FR/EIS/EIR are discussed below. More information about the alternatives eliminated from consideration can be found in Chapter 3, Section 3.3.

Alternative 1, No Action. Under the No Action Alternative, USACE would not conduct any additional work to address seepage, slope stability, overtopping, or erosion concerns in the Stockton metropolitan area and RD 17. As a result, if a flood event were to occur, the Cities of Stockton, Lathrop, and Manteca, and surrounding agricultural and open space lands, would remain at risk of a possible levee failure and flooding. In addition, the associated risk to human health and safety, property, and the adverse economic impact that serious flooding could cause would continue, and the risk of a catastrophic flood would remain high. Regular operations and maintenance of the levee system would continue as presently executed by the local maintaining entities.

Alternative 7a, North and Central Stockton, Delta Front, Lower Calaveras River, and San Joaquin River Levee Improvements excluding RD 17. This alternative would implement levee improvements around North and Central Stockton and two closure structures; one on Fourteenmile Slough and one on Smith Canal. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), and levee geometry improvements, and would address projected sea level change by including raising the levee height where needed. There is an additional levee extension on Duck Creek to prevent flanking.

Alternative 7b, North and Central Stockton, Delta Front, Lower Calaveras River, and San Joaquin River Levee Improvements including RD 17. This alternative would implement the same levee improvements and closure structures as Alternative 7a, but would also implement levee improvements and about 2.2 miles of new levees at the Old River flow split and a tie-back levee in RD 17. The new levees would include a cutoff wall to address potential seepage issues.

Alternative 8a, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River, and Stockton Diverting Canal Levee Improvements excluding RD 17. This alternative would implement levee improvements and two closure structures in North and Central Stockton. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), and levee geometry improvements, and would address projected sea level change by including raises in levee height where needed. There is an additional levee extension on Duck Creek to prevent flanking.

Alternative 8b, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River, and Stockton Diverting Canal Levee Improvements including RD 17. This alternative would implement levee improvements without including the Mormon Channel bypass. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements, and would address projected sea level change by including raising the levee height where needed. There would also be approximately 2.2 miles of new levee constructed to extend the RD 17 tie-back levee and the secondary levee at the Old River flow split. The new levees would include a cutoff wall to address potential seepage issues.

The difference in extent between Alternatives 7a, 7b and Alternatives 8a, 8b is the addition of reaches on the Calaveras River and the Stockton Diverting Canal left bank levee. The extra length of the reaches in Alternatives 8a, 8b totals approximately 55,500 feet (10.5 miles) of levee.

Alternative 9a, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass excluding RD 17. This alternative would implement levee improvements, as well as channel improvements within the Mormon Channel Bypass to increase capacity, and create a diversion control structure on the Stockton Diverting Canal that would restore flood flows to the Mormon Channel. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), and levee geometry improvements, and would address projected sea level change by including raising the levee height where needed. There is an additional levee extension on Duck Creek to prevent flanking. The diversion control structure at the Stockton Diverting Canal would consist of pipe culverts with gates that control releases to a maximum flow of approximately 1,200 cubic feet per second (cfs). Constructing the improvements to the Mormon Channel would require removal of much of the existing vegetation, yet the restoration of flood flows to the Mormon Channel would provide multiple benefits, which is a priority for the NFS. These benefits could include establishment of native vegetation, improved wetlands, and opportunities for passive recreation.

Alternative 9b, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass including RD 17. This alternative would implement levee improvements along with restoration of the Mormon Channel, including a diversion control structure at the Stockton Diverting Canal. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements, and would address projected sea level change by including raising the levee height where needed. There would also be approximately 2.2 miles of new levee constructed to extend the RD17 tie-back levee and the secondary levee at the Old River flow split. The new levees would include a cutoff wall to address potential seepage issues. The diversion control structure at the Stockton Diverting Canal would consist of pipe culverts with gates that control releases to a maximum flow of approximately 1,200 cfs. The restoration of flood flows to the Mormon Channel would serve multiple public needs, including flood risk reduction, habitat restoration, and recreation, which are priorities of the NFS.

Alternatives 9a and 9b differ from Alternatives 7a and 7b by the addition of 33,400 feet (6.3 miles) of improvements along Mormon Channel, and inclusion of a diversion structure to divert flows from the Stockton Diverting Canal into Mormon Channel.

Mormon Slough's course extends in a general southwesterly direction from Bellota to the Stockton Diverting Canal flow diversion structure. The structure diverts all flood flows to the diverting canal, which discharges into the Calaveras River. The Mormon Slough below the diverting dam is referred to locally as Mormon Channel. The source of flow in Mormon Channel is the local tributary area downstream of the diversion structure.

Before construction of the Stockton Diverting Canal, Mormon Channel was connected to Mormon Slough and was perennial in most years. Today, the channel receives local storm water runoff and intermittently contains water.

Reintroducing flood flows to Mormon Channel by establishing the Mormon Slough Bypass would involve construction of a diversion structure at the confluence of Old Mormon Slough with the Stockton Diverting Canal, and excavation within Mormon Channel in order to establish the channel as Mormon Slough Bypass. This would likely improve conditions for the remaining vegetation and would likely increase the health and encourage expansion of riparian vegetation along much of this channel.

AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION

Initial evaluation of project effects indicated that there would likely be little to no effect on current geology and geomorphology, seismicity, soils and mineral resources, hydrology and hydraulics, and public health and environmental hazards. An evaluation of environmental effects determined that each of the final alternatives, including the RP, has the potential for adverse effects on air quality and greenhouse gasses, water quality, groundwater, wetlands and waters of the U.S., vegetation, wildlife, special status species, fisheries, aesthetics, recreation, transportation, noise, cultural resources, utilities and public services, and land use, and socioeconomics. A comparison of environmental effects by alternative is provided in Table ES-1. The majority of the resource categories have a similar range of effects with the implementation of any of action alternatives.

Alternatives 7a, 8a and 9a differ from Alternatives 7b, 8b and 9b, respectively, in that the "b" alternatives all include levee improvements and new levee sections in RD 17. No work in RD 17 is proposed in any of the "a" alternatives. Each alternative proposes exactly the same improvements in North Stockton. Each pair of alternatives —7a and 7b, 8a and 8b, 9a and 9b— propose the same improvements in Central Stockton except that the "a" alternatives include a small additional levee extension on Duck Creek not included in the "b" alternatives. The differences among these alternatives are highlighted in Table ES-1.

Table ES-1: Differences Among the Action Alternatives

	Alternatives					
	7a	7b	8a	8b	9a	9b
Additional levee improvements on Lower Calaveras River			X	X		
Levee Improvements on Stockton Diverting Canal			X	X		
Flood Bypass through Old Mormon Channel					X	X
Levee extension on Duck Creek	X		X		X	
RD17 levee improvements and new levee segments		X		X		X

Because of the great extent of the proposed levee improvements and new levee segments, all of the "b" alternatives would have more effects than the "a" alternatives on vegetation, wildlife, fish, special status species, noise, air quality, aesthetics, recreation, and growth. Alternative 7a is the smallest alternative and has the least environmental impact. Alternatives 8b and 9b would have the greatest potential effects on vegetation, wildlife, fish, special status species, noise, air quality, aesthetics, and recreation. Alternatives 9a and 9b would restore flood flows to Old Mormon Channel and create opportunities for future restoration of riparian and wetlands habitat, yet the excavation required to establish the flood bypass would have greater potential impacts on air quality and transportation than the other alternatives. In comparison with Alternatives 7a and 9a, Alternative 8a would result in potential impacts to noise, recreation, and air quality as a result of the additional levee improvements on the Lower Calaveras River and the Stockton Diverting Canal.

Construction of the flood risk management features for the RP would detrimentally affect fish and wildlife habitat. It would cause permanent losses of riparian habitat from construction activities required for excavations, floodwalls, levees, and Vegetation ETL compliance, affecting 139 acres of native riparian habitat. The RP would remove about 19,630 LF of shaded riverine aquatic habitat. The RP would remove approximately 10.75 acres of existing wetland habitat primarily associated with ditch fill and relocation. An in-channel closure structure on Smith Canal and another on Fourteenmile Slough would temporarily affect 4 acres of open water, and 234 acres of shallow water habitat. Forty-one elderberry shrubs within the construction footprint would be transplanted to an on-site conservation area. The RP would permanently impact 12.5 acres of upland and 0.5 acres of aquatic giant garter snake (GGS) habitat. It would also temporarily impact 111.5 acres of upland and 6 acres of aquatic GGS habitat.

Some adverse environmental effects would be reduced to a less than significant level through project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices. Compensatory mitigation would be required to reduce some impacts to less than significant. Even with compensatory mitigation, impacts would remain significant and unavoidable for the vegetation, wildlife, fisheries, special status species, recreation, aesthetics, transportation, noise, and cultural resources.

COMPLIANCE WITH APPLICABLE LAWS, REGULATIONS, POLICIES AND PLANS

This document is a joint EIS/EIR, and will fully comply with NEPA and CEQA requirements. The project will comply with all Federal and State laws, regulations, Executive Orders, and permit requirements.

PUBLIC INVOLVEMENT

Public involvement activities associated with the project included public meetings, Native American Tribe and agency meetings, and distribution of the Draft FR/EIS/EIR for public review and comment. On January 15, 2010, USACE published the Notice of Intent (NOI) to prepare a joint EIS/EIR for the LSJRFS in the Federal Register (Vol. 75, No. 10) and SJAFCA published a Notice of Preparation (NOP) with the State Clearinghouse (SCH # 2010012027). One public meeting was held on January 27, 2010 at the University of the Pacific in Stockton to initiate scoping on the FR/EIS/EIR while gathering additional information and community comments from citizens who live, work and commute near the project area. The public was invited to submit written comments during and after the meeting.

The Draft FR/EIS/EIR was circulated for a 45-day review to Federal, State, and local agencies, organizations, and individuals who had previously expressed an interest in the project. Public notification of the availability of the draft document for comment was published in the Federal Register and in local newspapers, posted to the Sacramento District website, electronically mailed to interested parties, and directly mailed to owners and occupants of property adjoining the parcel or parcels on which the project is located (CEQA Guidelines Section 15087). A public workshop was held during the review period to provide additional opportunity for comments on the Draft FR/EIS/EIR. All comments received during the public review period have been considered and incorporated into the Final FR/EIS/EIR, as appropriate. Comments and responses are included in the Environmental Addendum.

COMMUNICATION WITH NATIVE AMERICANS

Coordination with Native Americans included letters to the Ione Band of Miwok Indians, the Buena Vista Rancheria of Me-Wuk Indians, the Wilton Rancheria, the Notomne/Northern Valley Yokuts, and the California Valley Miwok Tribe in 2013. A draft PA was coordinated with the Tribes between 2013 and 2016. The United Auburn Indian Community expressed interest in 2015 and has since been included in consultations.

The Draft Integrated Report was provided, and the Final Integrated Report will be provided to, the following Tribes: Wilson Rancheria, Nototomne/Northern Valley Yokuts, Californian Valley Miwok Tribe, Ione Band of Miwok Indian, United Auburn Indian Community, and Buena Vista Rancheria Me-Wuk Indians. A PA was signed by USACE and the State Historic Preservation Officer (SHPO) on May 11, 2016.

SIGNIFICANT ISSUES

Significant issues identified by agencies and the public related to construction of the LSJR Project are summarized below. These issues are based on preliminary studies and comments from formal and informal agency meetings, the public scoping meeting, and telephone conversations, letters, and emails.

- Preliminary air quality emission calculations indicate that construction would result in air emissions that could lead to violations of applicable State ambient air quality standards and not comply with the Federal Clean Air Act (CAA). Concurrent construction activity could contribute additional emissions that would cumulatively fail to meet the general conformity rule of the CAA. Air quality impacts would be mitigated to less than significant in one of the following ways. (1) Require the use of off-road equipment that meets or exceeds USEPA or California Air Resources Board (CARB) Tier 3 off-road emission standards for all off-road vehicle greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor would be required to prepare and submit a Construction Emissions Minimization Plan for review and approval. The plan would include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. (2) Implement a Verified Emission Reduction Agreement which would require payment of a fee to San Joaquin County Air Pollution Control District that would be used to purchase NOx emission reductions to offset all NOx emissions during the years when the Project's unmitigated NOx emissions exceed 10 tons.
- Construction of the project would require the permanent acquisition of private property within or near the construction area. Relocation of people, homes and businesses would be minimized to the extent feasible and consistent with the project purpose. Necessary relocations would be compensated under the Federal Relocation Act.
- Construction is expected to increase noise levels, affecting adjacent residents and local recreationists even under compliance with noise ordinances. Mitigation measures would be implemented to reduce impacts to the extent feasible. These measures are discussed in Chapter 5, section 5.19.10.
- Noise, visual aesthetics, and access would be compromised during construction. Mitigation measures would be implemented to reduce impacts on noise (see section 5.19.105.17.9), aesthetics (see section 5.18.10) and access (see section 5.17) Detours and alternative recreation locations would provide sufficient recreation opportunities in the study areas.
- Construction would include compliance with the USACE Engineer Technical Letter (ETL) 1110-2-583. The removal of vegetation on levees would result in significant impacts to biological resources in the project area. The impact analysis assumes that on the waterside, up to 50 percent of the native trees and shrubs on the lower slope and within the 15 foot O&M easement may be allowed to remain through a variance to the ETL. For the purposes of Federal Endangered Species Act (ESA) Section 7 consultation 25 percent of the native trees and shrubs were assumed to remain on the lower waterside slope and within the waterside easement. If the RP is authorized, rigorous engineering studies would be conducted during PED to determine the suitability of the levees for a variance.
- Construction of closure structures on Fourteenmile Slough and Smith Canal could result in take, as defined by the ESA, of special status fish species. The National Marine Fisheries Service and U.S. Fish and Wildlife Service issued biological opinions with incidental take statements in June 2016.
- The overall project would be a multi-phased effort that may require overlapping construction activities within the overall project area. The timeline used in this analysis assumes work is sequential. If the project is authorized, additional project information would be developed during preconstruction engineering and design phase (PED). Any revisions to the construction timing and sequencing would be evaluated to determine if impacts have been fully addressed in this final FR/EIS/EIR or if a supplemental NEPA and/or subsequent CEQA document would be required.

AREAS OF CONTROVERSY

NEPA requires identification of issues of known controversy that have been raised in the scoping process and throughout the development of the project. Potentially controversial issues that may arise discussed below.

Property Acquisition: A specific issue of concern involves potential conflicts with private property that is within or near the construction area. In some cases, permanent property acquisition may be needed for project construction, operation, and maintenance. Temporary construction easements may also be needed for construction staging and equipment access. These effects guide the Real Estate Plan and are generally described in Chapter 5, Section 5.14-Land Use.

Construction Related Effects: The levee system in the project area is close to residential areas and other developed land uses. Therefore, actions proposed by the project are likely to result in construction related effects that may include noise, traffic, air quality, visual resources, and recreation, and are specifically described in Chapter 5. A specific discussion about effects on residents is contained in Section 5.13, Socioeconomics and Environmental Justice.

Levee Encroachments and Vegetation: The project alternatives include removal, relocation, or replacement of features in, on, or under the levee or adjacent operations and maintenance (O&M) corridors such as structures, pipelines, walls, stairs, utilities, and other elements such as vegetation, to comply with USACE ETL 1110-2-583. Implementation of such guidance has stirred controversy in the Central Valley as cursory assessments have shown that much vegetation may require removal, resulting in effects on fish and wildlife habitat, including habitat for endangered and threatened species. This may affect recreation and aesthetics. This issue is described further in the effects discussions for vegetation, fish, wildlife, visual resources, and recreation in Chapter 5. Other encroachments are addressed in the land use and utilities sections of Chapter 5.

Executive Order 11988 and Growth Inducement: Application of the Executive Order to this study has raised concerns about the ability of local jurisdictions to meet planning and development goals. These concerns are particularly relevant to the RD17 portion of the project area. The project's potential to induce growth, or remove a potential barrier to growth, is discussed in Chapter 3, Section 3.6 and in Chapter 5, Section 5.22.

SCOPE OF ENVIRONMENTAL ANALYSIS

The LSJRFS FR/EIS/EIR documents the Feasibility Study's consideration of the level of Federal participation in FRM for the overall defined study area, including the Cities of Stockton, Lathrop, Manteca and surrounding urbanized areas. This Final FR/EIS/EIR analyzes the environmental effects of the proposed alternatives using a conservative approach that looks at typical cross sections and footprints for levee reaches. As planning proceeds, USACE, CVFPB and SJAFCA will continue to refine project elements, construction methods, equipment types and construction schedules with the intention of further reducing adverse impacts identified in Table ES-5, Chapter 4, and Chapter 5. Any refinements to project elements that occur during the PED or the construction phase will be reviewed and compared to what was evaluated in this FR/EIS/EIR to determine if supplemental NEPA and/or CEQA documentation will be required.

RECOMMENDED PLAN

The RP is Alternative 7a, North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements excluding RD 17 (Figure ES-2). This plan meets the study objectives of reducing flood risk and flood damages. The RP greatly reduces flood risk to people and property in the city of Stockton, revitalizing local levees that were built to reduce the chance of hazardous flooding in the area, affecting 122,000 residents. The plan also offers an estimated 84 percent reduction in expected annual property damage while enhancing security at 262 critical infrastructure sites, 12 of which are considered essential to life safety. With the RP in place, the North Stockton impact area improves from an approximate 15 percent annual chance of flooding in the highest risk areas to less than 1 percent annual chance of flooding. The Central Stockton impact area improves from a 12 percent annual chance of flooding in the highest risk areas to an approximate 2 percent annual chance of flooding. Further information about specific Annual Chance of Exceedance probabilities and the performance of levees for a range of hydrologic events within sub-impact areas can be found in Appendix A: Economics
.

The structural features of Alternative 7a include approximately 23 miles of levee improvements and two closure structures, one at Fourteenmile Slough and the other at Smith Canal. In addition to the structural features, the RP also recommends the local sponsors complete a Floodplain Management Plan, including a Comprehensive Flood Warning Emergency Evacuation Plan to address residual flood risks.

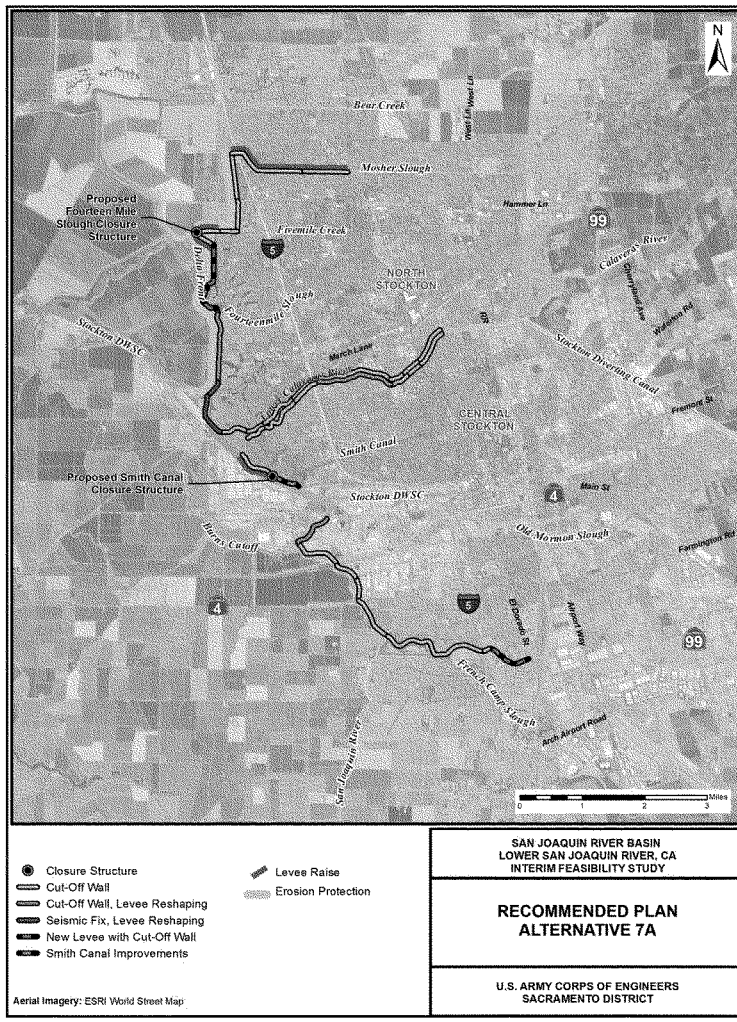


Figure ES-2: The Recommended Plan

ENVIRONMENTAL EFFECTS

Environmental effects of the alternatives were evaluated in Chapter 5 of the document and are summarized in Table ES-5.

ESTIMATED COST AND COST SHARING

Investment cost accounts from the Micro Computer-Aided Cost Engineering System (MCACES) cost estimate for the RP are displayed in Table ES-2 below.

Table ES-2: Estimated Costs of Recommended Plan ($1,000)

MCACES Account[2]	Description	Total First Cost[1]
01	Lands and Damages[3]	80,654
02	Relocations[4]	85,000
06	Fish and Wildlife	70,904
11	Levees and Floodwalls	566,599
15	Floodway Control and Diversion Structure	53,183
30	Planning, Engineering, Design[6]	144,901
31	Construction Management[7]	69,069
	Total First Cost[8]	1,070,309

Notes:
[1]Based on October 2017 price levels, 2.75% interest rate, and a 50-year period of analysis.
[2]Micro Computer-Aided Cost Engineering System (MCACES) is the software program and associated format used by USACE in developing cost estimates. Costs are divided into various categories identified as "accounts." Detailed costs estimates are presented in the Cost Engineering Addendum.
[3]Real Estate land costs, which include no damages.
[4]Relocations include relocating affected utilities
[6]16 percent of 06, 11, and 15 accounts.
[7]10 percent of 06, 11, and 15 accounts.
[8] Numbers reported may be slightly different than those presented in the appendices due to rounding.

The refined benefits and costs of the RP are summarized in Table ES-3.

Table ES-3: Annual Costs and Benefits for Recommended Plan ($1,000)

First Costs	$1,070,309
Interest During Construction	$231,829
Total Investment Cost	$1,302,138
Interest and Amortization[1]	$48,232
OMRR&R	$1,062
Total Annual Cost	$49,294
Total Annual Benefits	345,024
Net Annual Benefits	$295,730
Benefit to Cost Ratio	7.0

[1]October 2017 Price levels, 2.75% discount rate and a 50 year period of analysis.

Table ES-4 below shows the preliminary cost sharing for Alternative 7a. The NFS are reponsible for all Lands, Easements, Rights of Way, Relocations and Disposal Sites (LERRDs) costs, a minimum of 5 percent cash, and any additional cash needed to reach a minimum of 35 percent of the total project cost. The maximum non-Federal share is 50 percent of the total project cost.

Table ES-4: Summary of Cost Sharing Responsibilities for the Recommended Plan 1 ($1,000s - working level estimates)

MCACES Account	Item	Federal[1,2]	Non-Federal[1]	Total[1]
01	Lands and Damages[3]	10,675	69,979	80,654
02	Relocations	0	85,000	85,000
06	Fish and Wildlife Facilities	70,904	0	70,904
11	Levees and Floodwalls	566,599	0	566,599
15	Flood Control and Diversion Structure	53,183	0	53,183
30	Planning, Engineering, Design	144,901	0	144,901
31	Construction Management	69,069	0	69,069
	Subtotal	**907,575**	**154,979**	**1,070,309**
	Minimum 5% Cash Contribution		53,515	
	Additional Cash Contribution	(219,629)	219,629	
	Subtotal (NED Plan Cost Sharing)	695,701	374,608	
	Cost Sharing (%)	65	35	100
	Total (NED Plan Cost Sharing)[4]	**695,701**	**374,608**	1,070,309

Notes:
[1] October 2017 price levels, 2.75% interest rate, and a 50-year period of analysis.
[2] Federal Project First Costs are based on 65% of the NED Plan of $1,070,309,000.
[3] Lands, Easements, Rights of Way, Relocations and Disposal Areas.
[4] Numbers reported may be slightly different than those presented in the appendices due to rounding.

MAJOR CONCLUSIONS

The recommendation of USACE is that the report be finalized based on results of public review, internal policy review, ATR and IEPR of this Final FR/ EIS/EIR, and if warranted, recommended for authorization and implementation funding as a Federal project. The estimated first cost of the recommended plan is $1,070,309,000 and the estimated annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs are $1,062,000. The Federal portion of the estimated first cost is $695,701,000. The NFS portion of the estimated first cost is $374,608,000.

Table ES-5: Comparative Summary of Environmental Effects, Mitigation, and Levels of Significance

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Geology and Geomorphology							
Effect	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
Significance	Too speculative for meaningful consideration.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Mitigation	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Effect With Mitigation	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Seismicity							
Effect	The structural integrity of existing levees, berms, and bridges would remain at risk from high magnitude seismic events on active faults. Some levees in tidally influenced areas would remain at risk from seismically induced structural instability and/or failure due to liquefaction.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.	Levee improvements would reduce the vulnerability to structural failure due to seismic events.
Significance	Too speculative for meaningful consideration.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Mitigation	Incorporate seismic design elements into the FRM system.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Effect With Mitigation	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Soils and Mineral Resources							
Effect	A flood event could mobilize soils and transport and deposit them elsewhere in the system. Mining operations would continue to be at risk from flooding.	Short term soil disturbance due to construction activities.	Short term soil disturbance due to construction activities.	Short term soil disturbance due to construction activities.	Short term soil disturbance due to construction activities.	Short term soil disturbance due to construction activities.	Short term soil disturbance due to construction activities.
Significance	Too speculative for meaningful consideration.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Mitigation	None possible.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.	Implement BMPs during construction. At the end of construction, reseed disturbed areas with native herbaceous species.
Effect With Mitigation	Not applicable.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Hydrology and Hydraulics							
Effect	Emergency repairs during a flood event could result in loss of channel capacity and alteration of current geomorphic processes.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.	Closure structures would reduce riverine and tidal flow peaks to produce beneficial impacts by reducing flood risk.
Significance	Significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Mitigation	None possible.	None needed.	None needed.	None needed.	None needed.	None needed.	None needed.
Effect With Mitigation	Significant.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not applicable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Water Quality							
Effect	In a flood event, there is high risk of contaminants entering the water from utilities, stored chemicals, septic systems, and flooded vehicles. Flood flows would increase turbidity in the waterways through bank erosion.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.	Potential impacts include increased turbidity during in-water construction; runoff of exposed soils; and cement, slurry, or fuel spills during construction. Potential long term water quality impacts from closure structures.
Significance	Too speculative for meaningful consideration.	Significant	Significant	Significant	Significant	Significant	Significant and unavoidable.
Mitigation	Construct levee improvements and related FRM measures.	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop design and operation refinements in coordination with the Regional Water Quality Control Board (RWQCB).	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop operation and design refinements in coordination with the RWQCB.	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop design and operation refinements in coordination with the RWQCB.	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop design and operation refinements in coordination with the RWQCB.	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop design and operation refinements in coordination with the RWQCB.	Preparation of a Stormwater Pollution Prevention Plan, Spill Prevention Control and Countermeasures Plan, and a Bentonite Slurry Spill Contingency Plan and implementation of BMPs. Develop design and operation refinements in coordination with the RWQCB.
Effect With Mitigation	Not applicable.	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Groundwater							
Effect	Continue to implement groundwater management to ensure adequate recharge and sustainable extraction rates.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.	Potential construction-related impacts if cutoff walls penetrate into groundwater. Contaminants that could reach groundwater include sediment, oil and grease, and hazardous materials.
Significance	Less than significant.	Significant.	Significant.	Significant.	Significant.	Significant.	Significant.
Mitigation	Continue to update and implement groundwater management plans.	Develop and implement a Bentonite Slurry Spill Contingency Plan.	Develop and implement a Bentonite Slurry Spill Contingency Plan.	Develop and implement a Bentonite Slurry Spill Contingency Plan.	Develop and implement a Bentonite Slurry Spill Contingency Plan.	Develop and implement a Bentonite Slurry Spill Contingency Plan.	Develop and implement a Bentonite Slurry Spill Contingency Plan.
Effect With Mitigation	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Wetlands and Other Waters of the United States							
Effect	Stormwater runoff and erosion could introduce contaminants into receiving water. Emergency repairs could require placement of fill into open water and wetlands.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.	1 acre of permanent impact, and an additional 4 acres of temporary impact on open waters due to the closure structures. Ditches and toe drains adjacent to the levees would be filled and relocated due to construction of landside berms, levee reshaping, and levee height fixes.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	Use BMP to the extent practicable.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.	Compensate for loss of open water and wetland habitat through a combination of on-site mitigation and purchase of mitigation bank credits. Relocate effected ditches and toe drains outside of the levee footprint.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Air Quality and Climate Change							
Effect	Increased emissions during flood fighting activities without BMPs in place. Increased emissions during cleanup and reconstruction of the urban area.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.	Emissions of criteria pollutants from construction equipment, haul trucks, and barges.
Significance	Significant.	Significant.	Significant.	Significant.	Significant.	Significant.	Significant.
Mitigation	None possible.	Implement SJVAPCD construction emission control practices and BMPs.	Implement SJVAPCD construction emission control practices and BMPs.	Implement SJVAPCD construction emission control practices and BMPs.	Implement SJVAPCD construction emission control practices and BMPs.	Implement SJVAPCD construction emission control practices and BMPs.	Implement SJVAPCD construction emission control practices and BMPs.
Effect With Mitigation	Significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Vegetation							
Effect	Erosion during a flood event could cause significant vegetation loss. Flood fighting activities could prevent future vegetation growth on river banks.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 37,820 linear feet of potential SRA and 142 acres of woody riparian vegetation.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 59,898 linear feet of potential SRA and 274 acres of woody riparian vegetation.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 37,986 linear feet of potential SRA and 160 acres of woody riparian vegetation.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 64,297 linear feet of potential SRA and 245 acres of woody riparian vegetation.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 37,820 linear feet of potential SRA and 152 acres of woody riparian vegetation.	Loss of vegetation on, and adjacent to, the levees. Removal of up to 64,131 linear feet of potential SRA and 237 acres of woody riparian vegetation.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	Compensation would likely occur after the fact, but there would be significant direct impacts due to the temporal loss of vegetation.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Wildlife							
Effect	Erosion during a flood could cause significant wildlife habitat loss. Flood fighting activities could prevent future development of wildlife habitat on and adjacent to river and slough banks.	Loss of wildlife habitat and movement corridors in the project area.	Loss of wildlife habitat and movement corridors in the project area.	Loss of wildlife habitat and movement corridors in the project area.	Loss of wildlife habitat and movement corridors in the project area.	Loss of wildlife habitat and movement corridors in the project area. The Old Mormon Channel bypass would provide opportunities for a riparian corridor through Stockton.	Loss of wildlife habitat and movement corridors in the project area. The Old Mormon Channel bypass would provide opportunities for a riparian corridor through Stockton.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	Compensation would likely occur after the fact, but there would be significant direct impacts due to the temporal loss of habitat elements, principally vegetation.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.	Combination of on-site and off-site plantings and/or purchase of mitigation bank credits. BMPs implemented during construction to avoid impacts to special status species would also reduce potential impacts to common wildlife species.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Fisheries							
Effect	Flood fighting could prevent growth of vegetation on levee slopes and increase turbidity, thus impacting migration, spawning or rearing habitat.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation. Construction of the Old Mormon Channel bypass may create a corridor for migrating adult and juvenile fish.	Indirect effects to fish habitat from vegetation removal and from vibration during construction. Direct effects from the closure structures, including impacts from increases in turbidity. Long-term impacts from closure structures include fish movement and increased predation. Construction of the Old Mormon Channel bypass may create a corridor for migrating adult and juvenile fish.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	Compensation would likely occur after the fact but there would still be significant direct impacts due to the loss of vegetation.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures and Old Mormon Channel bypass would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.	A vegetation variance, if approved, would allow vegetation to remain on the lower waterside levee slope and adjacent easement. All disturbed lands would be reseeded following construction. BMPs would be implemented to address turbidity. Design and construction of the closure structures and Old Mormon Channel bypass would be closely coordinated with the resource agencies to avoid and minimize impacts to fisheries.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Special Status Species							
Effect	Flood event or flood fight could cause loss of habitat and fatality to species.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.	Direct affects to GGS, VELB, fish species, and Swainson's hawks during construction. Direct effects from construction and operation of closure structures. Indirect effects from vegetation removal and vibration during construction.
Significance	Significant	VELB and GGS: Significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Significant CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Significant CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Significant CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Significant CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Significant CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.
Conservation/ Mitigation Measures	None available	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.	Implement BMPs during construction. Transplant elderberry shrubs that cannot be avoided. Replace habitat for species either on-site or in close proximity to lost habitat. Work with resource agencies on design and operational criteria for the closure structures. Obtain a vegetation variance, if appropriate.
Effect with Conservation and Mitigation Measures	Significant	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.	VELB and GGS: Less than significant. CV Steelhead, Sacramento R winter-run Chinook salmon, CV spring-run Chinook salmon, Green sturgeon, Delta smelt: Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Socioeconomics and Environmental Justice							
Effect	Flooding of residential areas and displacement of populations during a flood event.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.	Disruption to residents alongside construction sites from traffic, noise, and dust. Acquisition of properties for construction and flood control easements.
Significance	Too speculative for meaningful consideration.	Significant.	Significant.	Significant.	Significant.	Significant.	Significant
Mitigation	None possible.	Federal Relocation Act compliance.	Federal Relocation Act compliance.	Federal Relocation Act compliance.	Federal Relocation Act compliance.	Federal Relocation Act compliance.	Federal Relocation Act compliance.
Effect With Mitigation	Not applicable.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Land Use							
Effect	Inconsistent with local land use policies requiring the protection of the existing urban area from flood damages. Potential for induced growth in RD17 consistent with future growth plans of the Cities of Stockton, Lathrop and Manteca.	Acquisition of properties for construction and flood control easements along the levees, floodwall, and closure structures in North and Central Stockton. Permanent loss of SRA.	Acquisition of properties for construction and flood control easements along the levees, floodwall, and closure structures in North and Central Stockton and in RD17. Potential for induced growth with reduction of flood risk in RD17. Permanent loss of SRA.	Acquisition of properties for construction and flood control easements along the levees, floodwall, and closure structures in North and Central Stockton. Permanent loss of SRA.	Acquisition of properties for construction and flood control easements along the levees, floodwall, and closure structures in North and Central Stockton and in RD17. Potential for induced growth with reduction of flood risk in RD17. Permanent loss of SRA.	Acquisition of properties for construction and flood control easements along the levees, floodwall, Old Mormon Channel flood bypass, and closure structures in North and Central Stockton and in RD17. Potential for induced growth with reduction of flood risk in RD17. Permanent loss of SRA.	Acquisition of properties for construction and flood control easements along the levees, floodwall, Old Mormon Channel flood bypass, and closure structures in North and Central Stockton and in RD17. Potential for induced growth with reduction of flood risk in RD17. Permanent loss of SRA.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	None possible.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.	Relocation Assistance and Real Property Acquisition Polices Act of 1970 compliance.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Transportation							
Effect	Potential for flooded roadways and railroad tracks in a flood event. Damage to roadways and railroad tracks from flooding and cleanup. Flood cleanup would create large volumes of truck traffic to remove flood debris.	Temporary delays in emergency response time, temporary railroad service disruptions, hauling materials through residential neighborhoods, and school zones, and potential interference with evacuation routes during construction.	Increased traffic on public roadways could potentially cause delays.	Increased traffic on public roadways could potentially cause delays.	Increased traffic on public roadways could potentially cause delays.	Increased traffic on public roadways could potentially cause delays.	Increased traffic on public roadways could potentially cause delays.
Significance	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	None possible.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.	Notification and coordination with all potentially affected parties during PED, and again before initiating construction activities. Before the start of each construction season, the primary construction contractors would develop a coordinated construction traffic safety and control plan. The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes.
Effect With Mitigation	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Utilities and Public Services							
Effect	In a flood event there could be significant damage to utility systems. Debris from flooded homes and properties could overwhelm solid waste disposal facilities.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.	Temporary disruptions to utility services possible, particularly during relocation of utilities that penetrate the levee.
Significance	Too speculative for meaningful consideration.	Significant.	Significant.	Significant.	Significant.	Significant.	Significant.
Mitigation	None possible.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.	Before beginning construction, coordination with utility providers to implement orderly relocation of utilities.
Effect With Mitigation	Not applicable.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Recreation							
Effect	Damage to recreation facilities during flooding and potential loss due to erosion.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.	Temporary closure of recreation facilities along the San Joaquin River, Calaveras River, Smith Canal, French Camp Slough, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, and Mosher Creek during construction. This includes closure of bike and walking trails, and boat launches. Temporary and long term changes to recreational boating would result from the closure of structures on Smith Canal and Fourteenmile Slough. Long-term impacts to passive recreation as a result of vegetation removal.
Significance	Too speculative for meaningful consideration.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	None possible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.	Notification and coordination with recreation users, boaters, and bike groups. Flaggers, signage, detours, and fencing to notify and control recreation access and traffic around construction sites. Compensatory plantings, as feasible.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Aesthetics							
Effect	A flood event would damage the visual character in the study area.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton. Floodwall and closure structure at Smith Canal in Central Stockton.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton and in RD17. Floodwall and closure structure at Smith Canal in Central Stockton.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton. Floodwall and closure structure at Smith Canal in Central Stockton.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton and in RD17. Floodwall and closure structure at Smith Canal in Central Stockton.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton. Floodwall and closure structure at Smith Canal in Central Stockton.	Vegetation loss and construction activities would disrupt the existing visual conditions along the levees in North and Central Stockton and in RD17. Floodwall and closure structure at Smith Canal in Central Stockton.
Significance	Less than significant.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	None possible.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.	If a variance to the Vegetation ETL is approved, fewer trees and shrubs would be removed and some replacement plantings could be provided on-site. Where feasible, appropriate trees and shrubs would be planted on the landside of the levees outside of the 15 foot no vegetation zone. Disturbed areas would be reseeded with native grasses.
Effect With Mitigation	Less than significant.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Noise							
Effect	Increased noise during flood fighting and reconstruction.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.	Increased noise and vibration in proximity to sensitive receptors due to construction activities.
Significance	Less than significant.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	Not applicable.	Coordination with local residents, compliance with noise ordinances, and BMPs.	Coordination with local residents, compliance with noise ordinances, and BMPs.	Coordination with local residents, compliance with noise ordinances, and BMPs.	Coordination with local residents, compliance with noise ordinances, and BMPs.	Coordination with local residents, compliance with noise ordinances, and BMPs.	Coordination with local residents, compliance with noise ordinances, and BMPs.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Public Health and Environmental Hazards							
Effect	Flooding could release potential household and industrial chemicals and cause damage to sewage treatment plants.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.	Potential release of hazardous chemicals used on the construction site. Encountering HTRW sites during construction.
Significance	Too speculative for meaningful consideration.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.
Mitigation	None possible.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.	Implement a SWPPP, BSSCP, and SPCCP to avoid accidental spills and releases into the environment. Known HTRW sites within the construction footprint would be removed and properly disposed of prior to construction. HTRW sites encountered during construction would be removed and properly disposed of. Borrow material would be tested prior to use to ensure that no contaminated soils are used for this project.
Effect With Mitigation	Not applicable.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.	Less than significant.

Resource	Alternative 1 No Action	Alternative 7a	Alternative 7b	Alternative 8a	Alternative 8b	Alternative 9a	Alternative 9b
Cultural Resources							
Effect	Damage to historic and prehistoric resources during a flood event.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, and closure structures.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, and closure structures.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, and closure structures.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, and closure structures.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, closure structures, and a flood bypass.	Adverse effects to cultural resource and to historic properties from construction of levee improvements, new levees, seepage berms, closure structures, and a flood bypass.
Significance	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.
Mitigation	None possible.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.	Preparation and implementation of a Programmatic Agreement, Historic Properties Management Plan, and Historic Properties Treatment Plans.
Effect With Mitigation	Not applicable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.	Significant and unavoidable.

CHAPTER 1 — STUDY INFORMATION

1.1 PURPOSE AND NEED FOR THE PROJECT AND REPORT

The purpose of the Lower San Joaquin River Feasibility Study (LSJRFS) is to investigate the extent of Federal interest in a range of alternative plans to reduce flood risk in the cities of Stockton, Lathrop, Manteca and surrounding urbanizing areas (study area). The objective of the non-Federal Sponsors (NFS), who are the Central Valley Flood Protection Board (CVFPB) and the San Joaquin Area Flood Control Agency (SJAFCA), is to meet the requirements of California Senate Bill 5 (SB 5) of 2007, the Central Valley Flood Improvement Act, to achieve a 200-year level of protection for urban and urbanizing areas. The Federal and non-Federal objectives for the study are discussed in Chapter 2 , Sections 2.2.1 and 2.2.2, respectively. The NFS is responsible for demonstrating compliance with State of California requirements for any proposed project resulting from this study. The study area experienced major floods in 1955, 1958, and 1997, resulting in varying degrees of damage. Modeling of climate change for the Central Valley forecasts more frequent, short duration, high flow events that could potentially increase future flood risk. The existing levee system protects over 71,000 acres of mixed-use land, about 235,000 people and an estimated $28.7 billion in damageable property.

1.1.1 INTEGRATED REPORT

This is an integrated Feasibility Report/Environmental Impact Statement/Environmental Impact Report (FR/EIS/EIR) that describes the planning process and analyses used to identify the Recommended Plan (RP). This FR/EIS/EIR: (1) describes the flood risk in the cities of Stockton, Lathrop, Manteca and surrounding unincorporated areas; (2) evaluates a range of alternatives to reduce flood risk, including potential environmental impacts; (3) describes measures to minimize or mitigate for potential environmental impacts; (4) identifies a RP for implementation; (5) describes coordination, consultation and public involvement; and (6) describes compliance with Federal and State laws, Executive Orders and other requirements.

1.1.2 NEPA AND CEQA

This FR/EIS/EIR evaluates the potential environmental impact of the alternatives and proposes mitigation measures including avoidance, minimization and compensation to reduce, where feasible, any significant and/or potentially significant adverse impacts. The US Army Corps of Engineers (USACE) is the NEPA Federal Lead Agency. SJAFCA is the CEQA lead agency. On January 15, 2010, USACE published a Notice of Intent (NOI) to prepare an EIS for the LSJRFS in the Federal Register (Vol. 75, No. 10) and SJAFCA filed a Notice of Preparation (NOP) with the State Clearinghouse.

1.1.3 SCOPE OF ENVIRONMENTAL ANALYSIS

The FR/EIS/EIR documents the analyses undertaken in the Feasibility Study to consider the level of Federal participation in Flood Risk Management (FRM) for the overall defined study area. The environmental effects of the proposed alternatives are analyzed using a conservative approach that looks at typical cross sections and footprints for levee reaches. This is considered reasonable and appropriate given the current status of project planning and design and available information and data. The impact analysis conservatively assumes the most expansive construction footprint; in other words, the impacts discussed herein should be the greatest potential impacts associated with the proposed alternatives. As planning proceeds, USACE and the NFS will continue to refine project elements, construction methods, equipment types and construction schedules to further reducing adverse impacts.

If the RP is authorized and funding is appropriated by Congress, USACE and the NFS would begin

Preconstruction Engineering and Design phase (PED), which allows for design refinements based on the most current information. Any refinements to project elements that occur during PED or construction will be reviewed and compared to what was evaluated in this FR/EIS/EIR to determine if supplemental NEPA and/or CEQA documentation will be required. The scope of the FR/EIS/EIR includes evaluation of Federal interest in addressing seepage, slope stability, erosion and height concerns of the levees surrounding North and Central Stockton and RD17.

1.1.4 INTENDED USES OF THIS DOCUMENT

This FR/EIS/EIR recommends a plan to reduce flood risk to the study area and discloses potential impacts of the project alternatives. Impacts are determined by projecting the environmental conditions in the future with and without the project. This document also presents measures that could be implemented to avoid, reduce and/or compensate for potential environmental impacts. This FR/EIS/EIR will be circulated for a 30-day State and Agency Review. USACE Headquarters will review this report and prepare a report from the Chief of Engineers (Chief's Report). After review by the Office of the Assistant Secretary of the Army (Civil Works) and the Office of Management and Budget (OMB), the Chief's Report will be transmitted to Congress for potential project authorization and to allow appropriation of funds toward the Federal share of construction costs.

1.2 STUDY AUTHORITY

The general authority for flood control investigations in the San Joaquin River Basin arises under the Flood Control Act of 1936 (Public Law [PL] 74-738), Sections 2 and 6 and amended by the Flood Control Act of 1938 (PL 75-761). Further studies of the river system were requested in the May 8, 1964 resolution adopted by the Committee on Public Works of the House of Representatives. The resolution reads:

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Sacramento-San Joaquin Basin Streams, California, published in House Document No. 367, 81st Congress, 1st session and other reports, with a view to determine whether any modifications to the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California."

The LSJRFS is in accordance with Section 905(b) Analysis (Water Resources Development Act (WRDA) 1986) dated 23 September 2004, approved by the South Pacific Division (SPD) Commander, on June 10, 2005. The Section 905(b) Analysis was prepared with funds identified in House Report 108-357 (Conference Report to accompany H.R. 2745 for the Energy and Water Development Appropriations Act of 2004) for use under the Sacramento-San Joaquin River Basins Comprehensive Study to evaluate ER, FRM and related purposes for the Lower San Joaquin River (LSJR). House Report 105-190, which accompanied the Energy and Water Development Appropriations Act of 1998 (PL 105-62), identified initial funding and directed USACE to conduct a Comprehensive Study.

The Section 905(b) Analysis determined that there were potential FRM and ER projects in the LSJR area. This study focuses on FRM through additional scoping and coordination with the NFS, resource agencies and local stakeholders.

This study partially addresses the Sacramento–San Joaquin Basin Streams, California Comprehensive Study authority. Therefore, the LSJRFS will be called an "Interim Feasibility Report" to indicate the study

is addressing the flood risk issues of a specific area within the authority, rather than the entire authorized area. This report does not rule out additional studies for this or other areas, including RD 17, within the authorized study area at a future date.

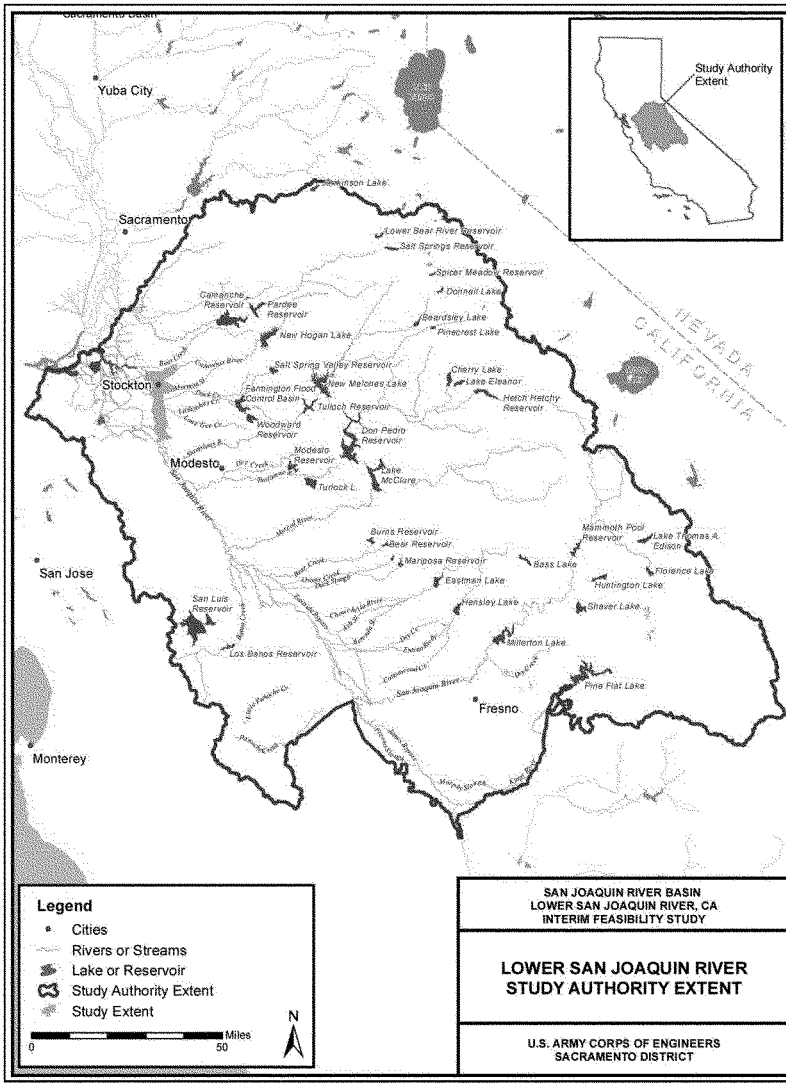


Figure 1-1: Study Authority Extent

1.3 PROJECT LOCATION, STUDY AREA AND PROJECT AREA

1.3.1 PROJECT LOCATION AND STUDY AREA

The study area is located along the lower (northern) portion of the San Joaquin River system in the Central Valley of California (Figure 1-1). The San Joaquin River originates on the western slope of the Sierra Nevada and emerges from the foothills at Friant Dam. It flows west to the Central Valley, where it is joined by the Fresno, Chowchilla, Merced, Tuolumne, Stanislaus and Calaveras Rivers and smaller tributaries as it flows north to the Sacramento-San Joaquin Delta (Delta). The study area includes the mainstem of the San Joaquin River from the Mariposa Bypass downstream to the city of Stockton. It also includes the distributary channels of the San Joaquin River in the southernmost reaches of the Delta: Paradise Cut and Old River and as far north as Tracy Boulevard, Middle River and Victoria Canal. Based on coordination with local interests, the study area initially included the Littlejohn Creek and Farmington Dam southeast of Stockton, Lathrop and Manteca; the city of Stockton extending from the Calaveras River, Mormon Channel and Bear Creek; and tributaries north of Stockton, including the Lodi waste water treatment plant at Thornton Road and Interstate 5 (Figure 1-2).

During scoping for the study, two potential sponsors were identified, the SJAFCA and the CVFPB. In collaboration with the NFS the study area was reduced to Stockton, Lathrop, Manteca and the surrounding urbanizing area (Figure 1-3). The reduced area encompasses 305 square miles, including the aforementioned incorporated areas and unincorporated portions of San Joaquin County.

During the plan formulation process, 15,000 acres of urban, urbanizing and agricultural lands were screened out due to lack of Federal interest and concerns with enabling development of undeveloped areas. The screening was consistent with Executive Order 11988, Floodplain Management. The remaining study area was divided into three separable elements (North Stockton, Central Stockton and Reclamation District (RD) 17. The separable elements are hydraulically separate, meaning that each area could have unique stand-alone solutions or alternatives proposed that would have no flood risk effect on adjacent areas.

1.3.2 PROJECT AREA

For the purpose of NEPA and CEQA, the "project area" is the footprint of the project where direct physical disturbance would occur. For the final array of alternatives evaluated in the impact analysis, this mainly includes existing levees and lands immediately adjacent to the levees. For all of the alternatives, the project area also includes portions of Fourteenmile Slough and Smith Canal, where in-water closure structures would be constructed. For two of the alternatives (Alternatives 9a and 9b) the "project area" would also include the Old Mormon Channel.

Mormon Slough's course extends in a general southwesterly direction from Bellota to the Stockton Diverting Canal flow diversion structure, which diverts all flood flows to the diverting canal that discharges into the Calaveras River. The Mormon Slough below the diverting dam is referred to locally as Mormon Channel. The source of flow in Mormon Channel is the local tributary area downstream of the diversion structure.

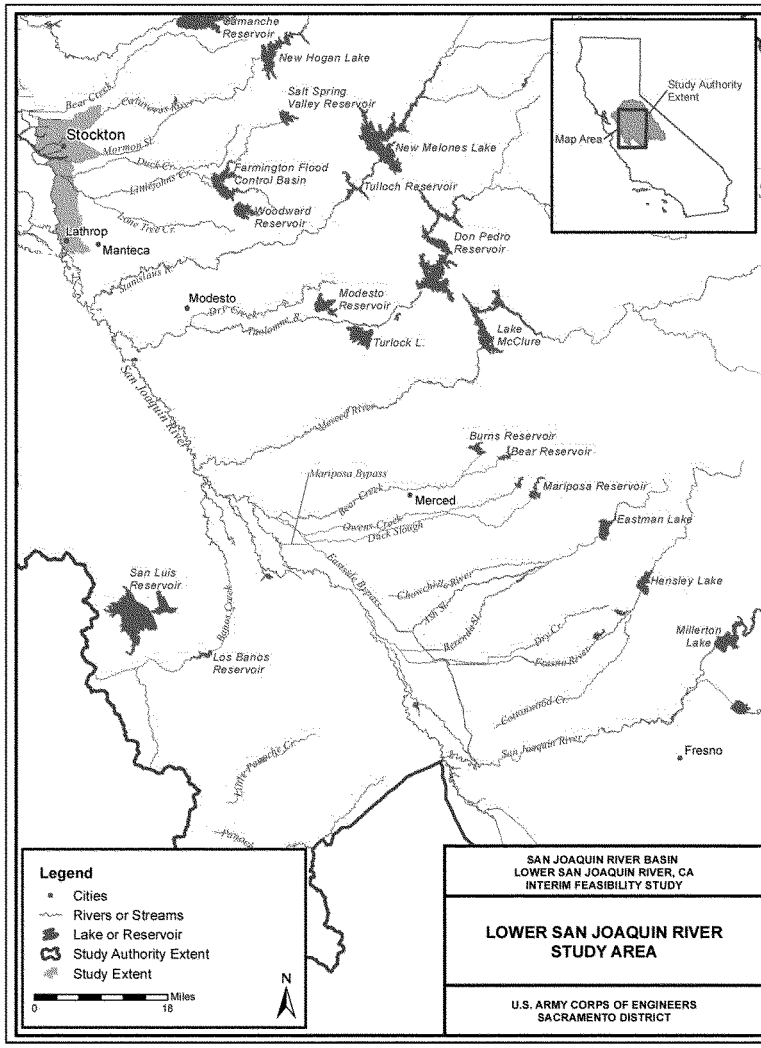


Figure 1-2: Study Area

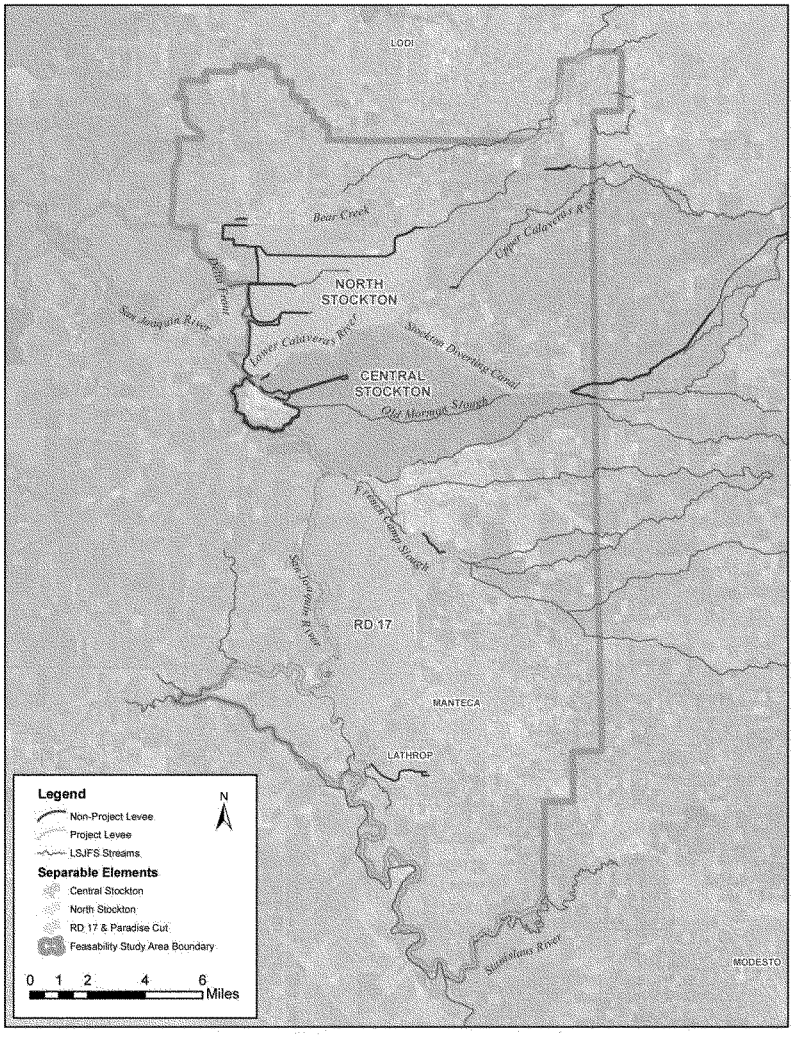


Figure 1-3: Lower San Joaquin River Feasibility Study Area

1.4 STUDY SPONSORS AND PARTICIPANTS

The NFS are SJAFCA and the State of California, represented by the CVFPB and supported by DWR. SJAFCA has local cooperation agreements with 11 Urban RDs (RD 2042, Bishop Tract; RD 2126, Atlas Tract; RD 2115, Shima Tract; RD 1608, Smith Tract; RD 2074, Sargent Barhardt Tract; RD 1614, Smith Tract; RD 828, Weber Tract; RD 404, Boggs Tract; RD 403, Rough and Ready Island; RD 17, Mossdale Tract; RD 2062, Stewart Tract), the Cities of Lodi, Stockton, Manteca, Lathrop and San Joaquin County.

1.5 HISTORY OF LOWER SAN JOAQUIN RIVER INVESTIGATIONS

The following USACE reports were reviewed as a part of this study:

Reference	Major Points
Lower San Joaquin River and Tributaries	Authorized by the Flood Control Act of 1944 and construction initiated in 1956, with various modifications made through the mid-1980's. The Federally-constructed portion of the project consists of 100 miles of intermittent levees along the San Joaquin River downstream of the Merced River, as well as along Paradise Cut, Old River, Camp Slough and the lower reaches of the Stanislaus and Tuolumne Rivers (Figure 1-3). The levees vary in height from 15 feet at the downstream end to an average of 6 to 8 feet over much of the project length. The project also included construction of New Hogan Dam on the Calaveras River, New Melones Dam on the Stanislaus River and Old Don Pedro Dam on the Tuolumne River. The Chowchilla and Eastside Bypasses were constructed by the State as part of the project. The project levees, along with upstream regulation, were designed to contain floods varying from once in 60 years probability at the lower end of the project to once in 100 years at the upper limits. Over the 60-year period since the project was authorized, the estimated level of performance of the project was reduced by changes in the hydrologic record, settlement, erosion, extensive sediment deposition, and establishment of vegetation between the levees despite maintenance efforts. The project cannot be maintained as originally envisioned due to newer environmental constraints.
San Joaquin River and Kings River, North Interim Flood Control Study, 1985	A reconnaissance study of flooding along the San Joaquin from Friant Dam and the Kings River from Stinson Weir, downstream to near Stockton, was initiated in 1984. It focused on sediment and vegetation removal to increase channel capacity. Study terminated in 1985 when no economically-justified solutions for additional FRM were identified.

Reference	Major Points
Draft General Design Memorandum and Environmental Statement, Lower San Joaquin River and Tributaries, California; Clearing and Snagging, January 1987	The Supplemental Appropriations Act of 1983 (PL 98-63) modified the completed Lower San Joaquin River and Tributaries project to include an additional $5 million for clearing and snagging on the San Joaquin River from Stockton upstream to Friant Dam. A draft General Design Memorandum was prepared by the USACE in 1987 to implement the authorized work, which was increased to $8 million by the Energy and Water Development Appropriations Act of 1988 (HR 100-2700). No economic benefit analysis was conducted. The USACE plan included habitat mitigation, but environmental objections couldn't be resolved and the project wasn't implemented.
Reconnaissance Report, San Joaquin River Mainstem, California, January 1993	Focused on FRM and ER problems along the mainstem of the San Joaquin River in coordination with the San Joaquin River Management Program. Plans included various combinations of floodwater diversions to wildlife refuges, agricultural lands, and other private lands, channel and levee improvements, and restoration of riparian and wetland habitats. The channel and levee improvements primarily consisted of removing aggraded sediment and vegetation from the channel and adding toe drains and berms to address seepage problems. One potentially justified, multiple-purpose plan consisting of diversion of floodwaters to three habitat restoration areas and restoration of 172 acres of riparian and shaded riverine aquatic habitat between River Miles 63 and 70 was identified. The three areas were the China Island Unit of the California Department of Fish and Game's North Grasslands Wildlife Area (3,300 acres), the Arena Plains National Wildlife Refuge and nearby conservation easement lands (11,500 acres) and 3,890 acres of lands within the Grasslands Water District. The plan would have created 5,580 acres of new wetlands, 840 acres of new riparian habitat, and 110 acres of new aquatic habitat at an estimated first cost of $44 million (1993 price level). FRM benefits were low, but exceeded separable FRM costs, indicating that a multiple-purpose project may be economically justified under current USACE policy. The study did not go beyond the reconnaissance phase due to lack of non-Federal funding.
Post-Flood Assessment, Sacramento and San Joaquin River Basins, California, March 1999	Part of the Energy and Water Development Appropriations Act of 1998 that focused on the impact of major floods in 1983, 1986, 1995, and 1997, including maps of flooded areas and estimates of economic damages. Described the development of flood protection in the Central Valley during the past 150 years, including major facilities, their operating objectives, and constraints.

Reference	Major Points
Sacramento and San Joaquin Comprehensive Study Interim Report, December 2002	Federal and State legislation authorized the development of comprehensive plans for FRM and ER along the Sacramento and San Joaquin Rivers in January 1997. The study developed analytical tools to evaluate how changes to the system would affect performance as a whole with respect to flood risk and degraded ecosystems. A comprehensive solution will require measures that increase conveyance capacity, increase flood storage, and improve floodplain management and levee reliability. It provides a way to develop projects that ensures system-wide effects are evaluated regardless of project scale, and an administrative structure to oversee processes. Factors to develop and implement in future projects are: use a science-based adaptive assessment and management approach to measure success and improve future project planning; continued coordination with resource management programs; complete a series of technical studies; consider potential climate changes; periodically update system-wide information; and use a scientific peer review process.
West Bear Creek Transitory Storage	Would restore transient storage of peak flood flows on the west side of the San Joaquin River near the Bear Creek confluence, including portions of the West Bear Creek and Freitas Units of the San Luis National Wildlife Refuge and Great Valley Grasslands State Park. Evaluated removal of non-Federal levee on the left bank of the San Joaquin River, or regulated inflows at three locations along the levee. FRM and ER benefits could be achieved at a lower cost by breaching the levee in several spots rather than removing it. The project would increase the frequency of inundation for 1,500 to 2,000 acres of floodplain habitats. Approximately 260 to 300 acres of grassland would be converted to wetland and riparian forest/scrub-shrub habitats, supporting a greater diversity and higher population of special status species. Results suggested that additional flood attenuation could be achieved by connecting the Mud Slough and Salt Slough flood basins upstream of San Joaquin River and including the East Bear Creek Unit.
Central Valley Basins Enhanced Flood Response and Emergency Preparedness	Developed a plan to increase the effectiveness of existing flood response and emergency preparedness systems to prepare, forecast, and warn residents of impending flooding from the Sacramento and San Joaquin Rivers and their tributaries. Of several alternatives, the most favorable provided incremental improvements to existing data collection and management, flood detection, and notification and decision-making systems.

1.6 EXISTING PROGRAMS, STUDIES AND PROJECTS

1.6.1 PROGRAMS

Federal Emergency Management Agency (FEMA), Flood Mitigation Assistance Program and the Hazard Mitigation Grant Program

These programs seek to reduce or eliminate loss of life and property damage due to natural and human-caused hazards. In order to qualify for these programs, a community must be enrolled in the National Flood Insurance Program (NFIP) and have a Flood Mitigation Plan approved by the FEMA Regional Director. This plan must include a description of the existing flood hazard and flood risk, including estimates of the number and type of structures at risk, repetitive loss properties and the extent of flood depth and damage potential. A project must be cost-effective, not costing more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future flooding were to occur, computed on a net present value basis. Applicants for these programs must compete for funding. The Cities of Stockton, Lathrop and Manteca are enrolled in the NFIP. San Joaquin County's enrollment covers the unincorporated areas, which includes the study area outside the cities' limits.

Designated Floodway Program

The CVFPB administers the Designated Floodway Program for California, which addresses land use management within the floodway. This program provides a nonstructural way to keep development from encroaching into flood-prone areas and reduces future potential flood damages by preserving the reasonable flood passage capacities of natural watercourses. The CVFPB adopts floodway boundaries, develops plans for modifications of boundaries and approves changes in acceptable use and types of structures within the floodways. Designated Floodway refers to the channel of the stream and that portion of the adjoining floodplain reasonably required for the passage of a design flood; it is also the floodway between existing levees as adopted by the CVFPB (formerly the Reclamation Board) or the Legislature. Floodway areas in the study area are primarily limited to the areas between levees.

Central Valley Flood Protection Plan (CVFPP)

The CVFPB approved the CVFPP (administered by DWR) in July 2012. SB 5 required that DWR and CVFPB address flooding problems in the Central Valley (Sacramento-San Joaquin Valley) and report to the Legislature with updates every 5 years. In response to SB 5, the State initiated the CVFPP to develop a comprehensive approach to FRM and related problems. SB 5 further requires local flood management agencies to achieve a "200-year urban level of flood protection" for urban or urbanizing areas of greater than 10,000 people, or meet the FEMA standard for rural, non-urbanized areas by 2025" for further development to be permitted in those areas. The CVFPP proposed a State-wide investment approach for improving the State-Federal FRM system to meet the new standard, while addressing ecosystem and other water related objectives. This approach permits modification or improvement of existing facilities of the State Plan of Flood Control (SPFC), construction of new facilities and opportunities for ecosystem improvements within the SPFC. The State is conducting basin-wide feasibility studies for the Sacramento River and San Joaquin River Basins. The conceptual proposals of the 2012 CVFPP are being further evaluated for technical and economic feasibility in the basin-wide studies. The results of various planning efforts by local interests have been evaluated by DWR for inclusion in the CVFPP 2017 update recently submitted to the CVFPB for approval. Further evaluations will continue and will be reported in the CVFPP 2022 update.

1.6.2 PROJECTS

Development of water resources in the basin began in the 1850s and currently includes large, multiple-purpose reservoirs, extensive levee and channel improvements, bypasses and local diversion canals (USACE, 1993). Many agencies were involved in water resource development within the study area, including USACE, United States Bureau of Reclamation (USBR), State of California, county irrigation districts, local reclamation districts and local levee districts.

Design flows for FRM projects within the study area are provided in Table 1-1. Reservoir projects upstream of the study area with dedicated, Federally authorized FRM space are listed in Table 1-2 and shown in Figure 1-1.

Table 1-1: Project Design Flood Flows

Reach	Design Flow (cfs)*	Design Freeboard (feet)	Source
Mormon Slough			
Bellota to Potter Creek	12,500	3 with levee 1.5 w/o levee	USACE, 1974
Potter Creek to Diverting Canal	13,500	3 with levee 1.5 w/o levee	USACE, 1974
Stockton Diverting Canal			
Mormon Slough to Calaveras River	13,500	3	USACE, 1974
Lower Calaveras River			
Diverting Canal to San Joaquin River	13,500	3	USACE, 1974
Potter Creek			
Jack Tone Road to Mormon Slough	1000		
San Joaquin River			
Stanislaus River to Paradise Dam (at head of Paradise Cut)	52,000	3	USACE, 1993
Paradise Dam to Old River	37,000**	3	USACE, 1963
Old River to French Camp Slough	22,000	3	USACE, 1963
French Camp Slough to Stockton Deep Water Ship Channel	18,000	3	USACE, 1963
French Camp Slough			
French Camp turnpike to San Joaquin River	3000	3	
Duck Creek			
Duck Creek Diversion to Mariposa Road	700	Not Available	USACE, 1967
Mariposa Road to French Camp Slough	900	Not Available	USACE, 1967
Bear Creek***			
Highway 99 to Western Pacific Railroad	5,500	3	USACE, 1963
Western Pacific Railroad to Pixley Slough	6,350	3	USACE, 1963
Pixley Slough to San Joaquin River	7,060	3	USACE, 1963

* - cfs = cubic feet per second
** - Design diversion capacity of Paradise Cut is 15,000 cfs
*** - Change in design flows by WRDA 2007 per revised Operations and Maintenance Manual, Federal Project levee ends at Disappointment Slough (4000 feet downstream of Pixley Slough)

Table 1-2: Reservoirs with Dedicated FRM Storage, San Joaquin River Basin

Reservoir	Owner	Year Constructed	Objective Flow (cfs)	Objective Flow Location	Gross Pool Storage (ac-ft)	Max Dedicated Flood Space (ac-ft)
Friant	USBR	1942	8,000 6,500	Little Dry Creek at Mendota Gage	520,500	170,000
Big Dry Creek	FMFCD	1948	700	Wasteway	30,200	30,200
Farmington	USACE	1951	2,000	Town of Farmington	52,000	52,000
Camanche	EBMUD	1963	5,000	Below Dam	430,900	200,000
New Hogan	USACE	1963	12,500	at Bellota	317,100	165,000
Los Banos	USBR	1965	1,000	Los Banos	34,600	14,000
New Exchequer	Merced ID	1967	6,000	Cressey	1,024,600	350,000
Don Pedro	Turlock ID	1971	9,000	Modesto	2,030,000	340,000
Buchanan	USACE	1975	7,400 7,000	Below Dam Chowchilla River at Madera	150,000	45,000
Hidden	USACE	1975	5,000	at Medara Canal	90,000	65,000
New Melones	USBR	1979	8,000	Orange Blossom	2,400,000	450,000

U.S. Fish and Wildlife Service. San Joaquin River National Wildlife Refuge

This refuge, established in 1987 under authority of the ESA, the Land and Water Conservation Fund Act and the Migratory Bird Conservation Act, is located within the historic floodplain of the confluences of the San Joaquin, Stanislaus and Tuolumne Rivers and downstream of the confluence with Orestimba Creek. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields and wetlands. The original refuge land base of 1,638 acres has grown through recent land acquisitions to 6,642 acres, within an approved refuge boundary of 12,877 acres.

U.S. Fish and Wildlife Service. San Luis National Wildlife Refuge

This 26,609-acre refuge is a mix of managed seasonal and permanent wetlands, a riparian habitat associated with three major watercourses and native grasslands/alkali sinks/vernal pools. It is primarily managed to provide habitats for migratory and wintering birds. The largest concentration of mallards, pintails and green-winged teal in the San Joaquin Valley are found here. One of only 22 herds of the indigenous Tule elk is located here, as are a variety of endangered, threatened and sensitive species.

U.S. Department of Agriculture, Natural Resource Conservation Service Wetland Reserve Program

The Natural Resource Conservation Service's Wetlands Reserve Program focuses on the restoration of a variety of wetland types throughout the State, including seasonal wetlands, semi-permanent marshes and vernal pools along the perimeter of the Central Valley, riparian corridors and tidally-influenced wetlands. The program has been used to restore land along the San Joaquin River that has experienced flooding.

Central Valley Project Improvement Act (CVPIA)

The Central Valley Project (CVP) was authorized by Congress in 1937 as a multipurpose development to store and transfer surplus water primarily from the Sacramento and Trinity River Basins, to the water-deficient lands of the San Joaquin River and Tulare Lake Basins. The project is operated by USBR. The CVPIA amended the CVP to include fish and wildlife protection, restoration and mitigation, having equal priority with irrigation and domestic water supply uses, fish and wildlife enhancement and power generation. The CVPIA gives first priority to measures that protect and restore natural channel and riparian habitat values.

1.6.3 STUDIES

- Delta Islands and Levees Feasibility Study: USACE and DWR are assessing ER and FRM problems and opportunities in the Delta area. A Draft Integrated FR/EIS, released for public review in April 2014, tentatively recommended 90 acres of intertidal marsh restoration in the central Delta. Pending reviews, the report will be finalized as an interim feasibility report that will make recommendations on construction projects and/or additional studies for authorization by Congress.
- Delta Long-Term Management Strategy: USACE, DWR, the California Bay-Delta Authority, the Delta Protection Commission, the State Water Resources Control Board (SWRCB) and the Central Valley RWQCB are developing a long-term management strategy for sediment management in the Delta, including dredging and dredged material placement and reuse.
- San Francisco Bay to Stockton Navigation Improvement Project: USACE, the Port of Stockton and Contra Costa County Water Agency are evaluating the efficiency of the movement of goods along the existing deep draft navigation route extending from the San Francisco Bay to the Port of Stockton. The project includes the John F. Baldwin and Stockton Ship Channels.

1.6.4 EXISTING PROJECTS DIRECTLY AFFECTED BY THE STUDY

There are three existing authorized projects covering portions of the levees being examined:

- The Calaveras River levees are components of the Mormon Slough Project as authorized by the Flood Control Act of 1962 (PL 874, October 23, 1962, 87th Congress, 2nd Session).
- The French Camp Slough right bank levee to the east of Interstate 5 is a component of the Duck Creek Project as authorized by Section 205 of the 1948 Flood Control Act as amended by Public Law 685, 84th Congress, 2nd Session.
- The San Joaquin River right bank levees along RD 404 are part of the Lower San Joaquin River and Tributaries Project as authorized by the Flood Control Act of 1944 (PL 534, December 22, 1944, 78th Congress, 2nd Session), as modified by PL 327, 84th Congress, 1st Session).

Current O&M responsibilities are as follows:

- Mormon Slough Project: SJAFCA and CVFPB
- Duck Creek Project: San Joaquin County Flood Control & Water Conservation District
- Lower San Joaquin River and Tributaries Project: CVFPB

1.7 ENVIRONMENTAL REGULATORY FRAMEWORK

1.7.1 NEPA

NEPA provides an interdisciplinary framework for Federal agencies to develop information that will help them to take environmental factors into account in their decision-making (42 USC Section 4321, 40 CFR Section 1500.1). According to NEPA, an EIS is required whenever a proposed major Federal action (e.g., a proposal for legislation or an activity financed, assisted, conducted, or approved by a Federal agency) would result in significant effects on the quality of the natural and human environment. A "cooperating agency" is defined in NEPA regulations as any Federal agency, other than a lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposed project or project alternative. A State or local agency of similar qualifications or, when the effects are on lands of tribal interest, a Native American tribe may, by agreement with the lead agencies, also become a cooperating agency (40 CFR 1508.5). For the LSJRFS, CVFPB, DWR and SJAFCA are cooperating agencies under NEPA.

1.7.2 CEQA

According to the State CEQA Guidelines (Section 15064[f][1]), preparation of an EIR is required whenever a project may result in a significant environmental impact. An EIR is an informational document used to inform public agency decision makers and the general public of the significant environmental effects of a project, identify possible ways to mitigate or avoid the significant effects and describe a range of reasonable alternatives to the project that could feasibly attain most of the basic objectives of the project while substantially lessening or avoiding any of the significant environmental impacts. Public agencies are required to consider the information presented in the EIR when determining whether to approve a project. CEQA requires that State and local government agencies consider the environmental effects of projects over which they have discretionary authority before taking action on those projects (California Public Resources Code [PRC] Section 21000 et seq.). CEQA also requires that each public agency avoid or reduce to less-than-significant levels, wherever feasible, the significant environmental effects of projects it approves or implements. If a project would result in significant environmental impacts that cannot be feasibly mitigated to less-than-significant levels, the project can still be approved, but the lead agency's decision makers must issue a "statement of overriding considerations" explaining in writing the specific economic, social, or other considerations that they believe, based on substantial evidence, make those significant and unavoidable effects acceptable.

For the purposes of CEQA, Responsible Agencies are those public agencies, other than the Lead Agency, that have discretionary approval power over the project (CEQA Guidelines Section 15381). These agencies are required to rely on the Lead Agency's environmental document in acting on whatever aspect of the project requires their approval, but must prepare and issue their own findings regarding the project (State CEQA Guidelines Section 15096). Trustee Agencies are those that have jurisdiction over certain resources held in trust for the people of California but do not have legal authority over approving or carrying out the project. For the LSJR Project, CVFPB is a Responsible Agency under CEQA. Responsible and Trustee Agencies for the project are identified in Table 1-3.

Table 1-3: Responsible and Trustee Agencies (CEQA)

Agency	Jurisdiction
California Department of Fish and Wildlife	Fish and wildlife Native plants designated as rare or endangered Game refuges Ecological reserves
California Department of Conservation	Williamson Act lands
California State Lands Commission	State-owned "sovereign" lands
Responsible Agency	
U.S. Environmental Protection Agency	NEPA and Clean Water Act coordination
U.S. Fish and Wildlife Service	Fish and wildlife and Endangered Species Act
National Marine Fisheries Service	Anadromous fish and Endangered Species Act
U.S. Department of Agriculture	Prime farmland conversion
California Department of Fish and Wildlife	Fish and wildlife Native plants designated as rare or endangered Game refuges Ecological reserves
Office of Historic Preservation	Historic and cultural resources
Central Valley Flood Protection Board	Levee modifications
California Air Resources Board	Air quality
Regional Water Quality Control Board	Water quality and discharges to water bodies
California Department of Water Resources	State water and flood management interests
San Joaquin County/State Mining and Geology Board	Surface mining and reclamation activities associated with borrow
City of Stockton	Land use designations
City of Lathrop	Land use designations
City of Manteca	Land use designations
Reclamation District 17	Levee operation and maintenance
Reclamation District 404	Levee operation and maintenance
RDs 1604, 2074, 1608, 1614, 828	Levee operation and maintenance

1.8 REPORT ORGANIZATION

The organization and chapter headings in this FR/EIS/EIR reflect both the plan formulation process and environmental documentation requirements. The headings corresponding to sections required by NEPA in an EIS are noted with an asterisk (*). Several chapters also relate to the six steps of the USACE planning process.

The first chapter, Study Information, introduces the study, discusses the purpose and need*, authority, study area, NFS and previous investigations covering the LSJR area. The integrated nature of the report is also explained.

The second chapter, Need and Objectives for Action, covers the first step in planning (specification of water and land resources problems and opportunities).

The third chapter, Plan Formulation, covers formulation of alternatives, comparison of alternative plans and selection of the RP based upon the comparison of the alternative plans.

The fourth chapter, Description of Final Alternatives*, provides a detailed description of the final alternative plans, including the no action alternative. This includes the purpose and construction details of the various measures, as well as the locations and specific measures included in each of the final alternatives.

The fifth chapter, Affected Environment and Environmental Consequences, describes the existing resources in the study area and evaluates the effects and significance of the final alternatives on those resources. Avoidance, minimization and mitigation measures are also proposed to reduce any effects to less than significant. The chapter covers inventory, forecast and analysis of water and land resources in the study area and an evaluation of the effects of the alternative plans.

The remaining chapters of the report discuss public involvement, review and consultation (Chapter 6); describe compliance with applicable laws, policies and plans (Chapter 7); describe the RP (Chapter 8); present the final study recommendations (Chapter 9); list the recipients* of the FR/EIS/EIR (Chapter 10); list the report preparers (Chapter 11); amd list the references (Chapter 12). A list of acronyms and abbreviations precedes Chapter 1.

CHAPTER 2 — NEED AND OBJECTIVES FOR ACTION

2.1 PROBLEMS AND OPPORTUNITIES

A problem is an existing undesirable condition to be changed. An opportunity is a chance to create a future condition that is desirable. Within the context of solving problems, opportunities contribute to the overall beneficial outcome of the project. The difference between problems and opportunities is often indistinct, but in both cases a changed future condition is preferred. The feasibility study identifies, evaluates and recommends to decision makers an appropriate, coordinated and implementable solution to the identified water and land resources problems and opportunities for the LSJRFS area. The following key problems were identified during the planning process by the study team and concerned stakeholders.

2.1.1 FLOODING

Problem: There is significant risk to public health, safety and property in the study area associated with flooding.

The study area is located in the Central Valley of California which has very little topographic relief, resulting in potential flooding of areas far from water courses (Figure 2-1). Due to the flat topography, the study area is prone to deep flooding as demonstrated for a 0.2% annual chance exceedance (ACE) event (Figure 2-2). Flow monitoring data has been collected for the San Joaquin River since around 1930 at the Vernalis gage site (Figure 2-3). The flow data shows several significant flow events, the most recent in 1997. Major events occurred three times since the 1950s. The 1955 event had the highest flows recorded on the Calaveras River at Bellota and 1,500 acres of Stockton were inundated to depths of six feet for as long as eight days (Figure 2-4). The 1958 event inundated 8,500 acres between Bellota and the Diverting Canal with flood waters up to two feet deep and inundation durations from two to 10 days. The 1997 event resulted in the evacuation of the Weston Ranch area of Stockton at the north end of RD 17. While the 1997 event did not directly damage areas of Stockton, Lathrop or Manteca, there were 1,842 residences and businesses affected in San Joaquin and Stanislaus Counties. There were also significant flood-fighting efforts conducted during the 1997 event in RDs 404 and 17. Between the two RDs, there were 37 sites flood-fought. Damages in San Joaquin County for the 1997 event were estimated to be near $80 million.

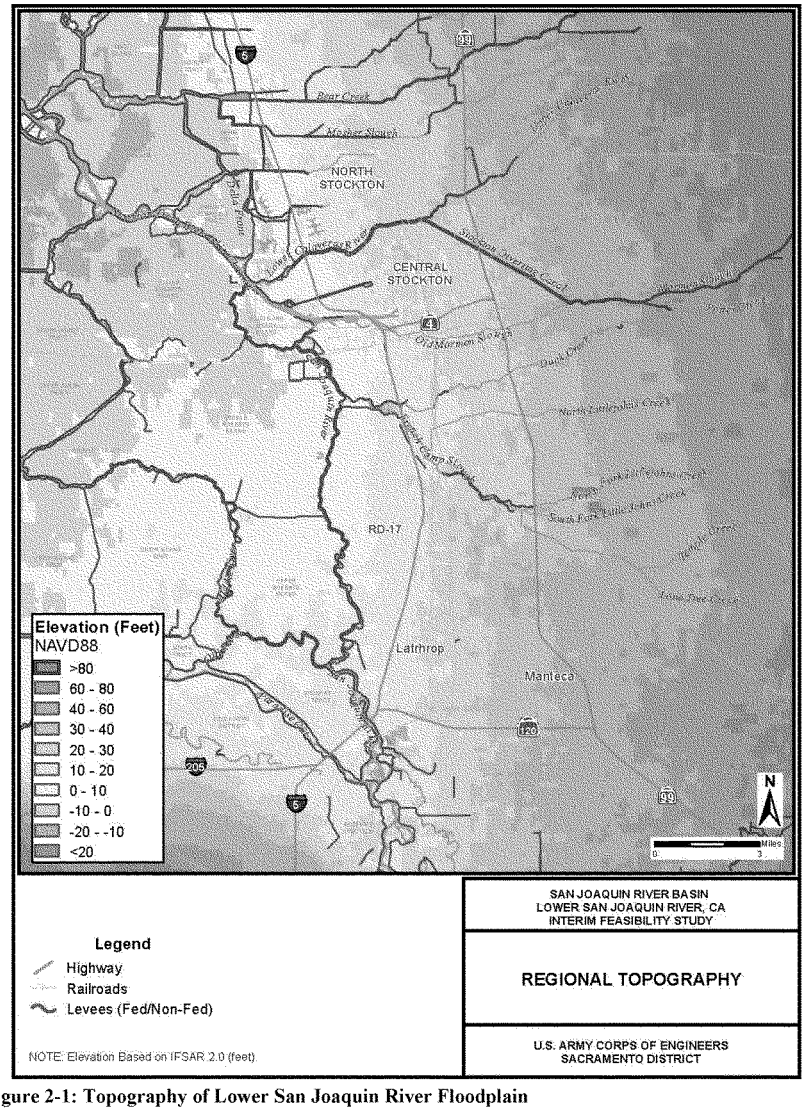


Figure 2-1: Topography of Lower San Joaquin River Floodplain

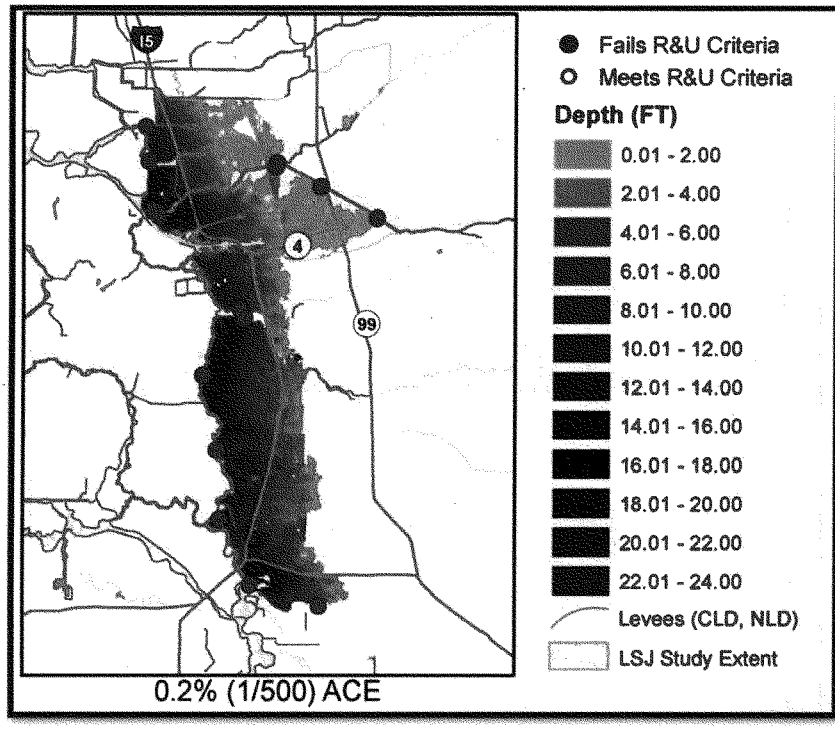


Figure 2-2: 0.2% Median ACE Floodplain

For explanation of Figure 2-2 Risk and Uncertainty criteria dictate whether or not a breach occurs at an index point (red dots or circles). Breach simulation is shown if the levee does not pass assurance criteria described in Engineer Circular (EC) 1110-2-6067. Assurance is defined as the probability that a target stage will not be exceeded during the occurrence of a specified flood. The value may include geotechnical failure considerations. This term is also referred to as Conditional Non-Exceedance Probability. Levees identified in the figure are based on the California Levee Database (CLD) and National Levee Database (NLD).

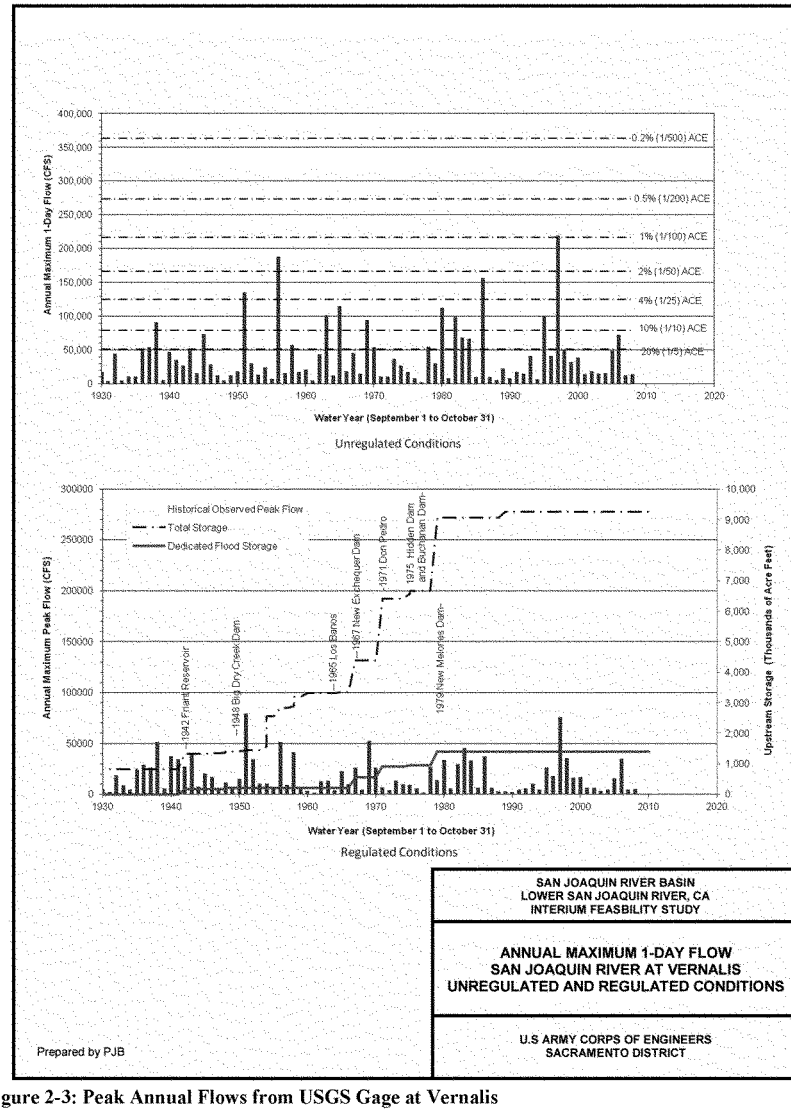


Figure 2-3: Peak Annual Flows from USGS Gage at Vernalis

Figure 2-4: Flooding Looking West Across the South Stockton Area (1955)

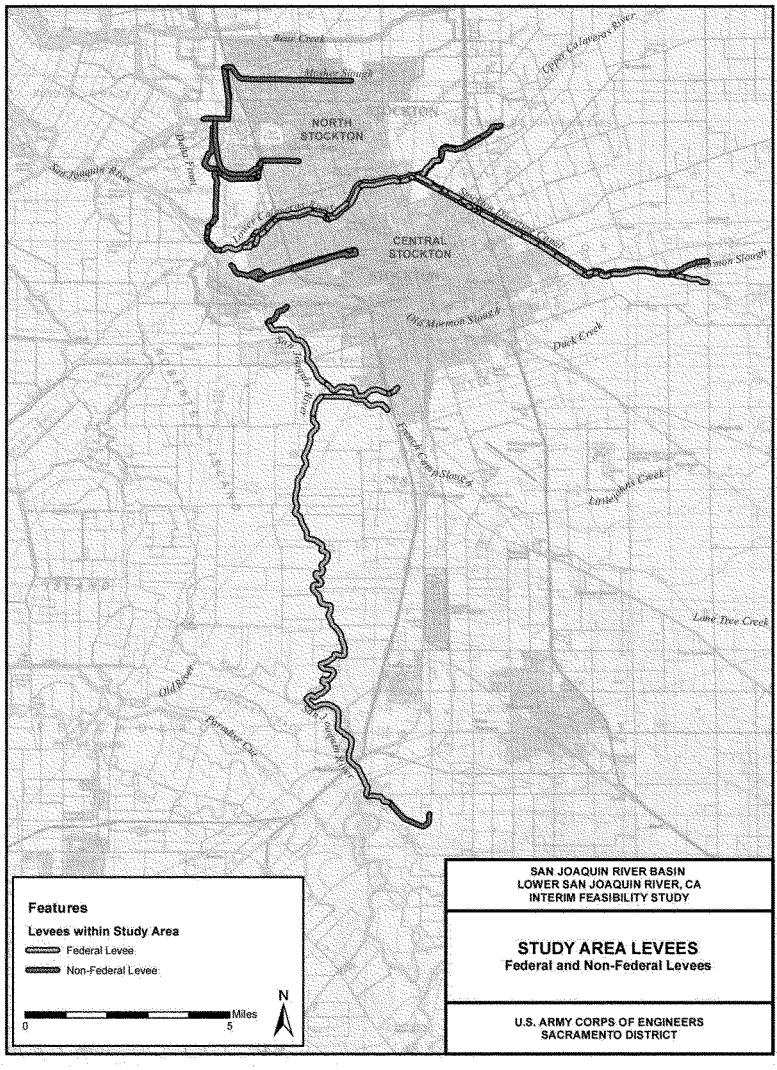


Figure 2-5: Study Area Levees

The primary risk of flooding in the study area is geotechnical failure of the existing levees and not hydrologic or hydraulic factors that result in levee overtopping. Recent geotechnical analysis and evaluation of historical performance during past flood events have resulted in a greater understanding of underseepage and a revision of levee design criteria. Geomorphologic and geotechnical studies identified subsurface features, such as former river channels and meanders. The potential for seepage to occur along the existing levees is created by discontinuous layers of coarse-grained pervious soils (i.e., sands and gravels) found at varying depths of up to 100 feet. During high water events, river water can enter the pervious soil layers and then move laterally under/through the levee. Excessive seepage can erode soil within the levee and lead to a rapid collapse and subsequent breach. Historically, foundation conditions were evaluated assuming homogeneous materials, but the floods of 1986 and 1997 and the resulting levee failures throughout the Central Valley resulted in a revision of the criteria for the evaluation of underseepage. The risk of levee failure is not due to design deficiency or to lack of O&M of the existing levees, but to a better understanding of the mechanics of underseepage in the Central Valley. The levees within the study area do not meet current USACE levee design criteria and are at risk of breach failure at stages considerably less than levee crest elevations. This is evidenced by historical levee boils and heavy seepage at river stages less than design flows. Proposed project modifications will address the improved understanding of system performance effects of through and under-seepage while returning the levee system to compliance with authorized performance criteria.

Geotechnical related issues such as underseepage breach failures result in large volume flood flows at high velocities that are sudden and unpredictable. These failures have minimal warning and minimal time for effective implementation of evacuation and emergency plans. Study area flood events generally occur during the winter months when colder air and water temperatures significantly increase the risk of death by exposure. The risk probability of unexpected levee failure coupled with the consequence of basin-wide flooding presents a continued threat to public safety, property and critical infrastructure in the LSJR basin.

Table 2-1: Structures Located within the 1/500 ACE Floodplain

Economic Impact Area	Residential	Commercial	Industrial	Public	Total Structures
Rural	1,921	25	23	10	**1,979**
Urban	73,391	2,865	888	513	**77,657**
Total	**75,312**	**2,890**	**911**	**523**	**79,636**

Table 2-2: Value of Damageable Property within the 1/500 ACE Floodplain ($1,000s) October 2017 Price Levels

	Structural Value		Content Value		
Land Use	**Rural**	**Urban**	**Rural**	**Urban**	**Total**
Residential	311,072	8,756,577	311,073	8,743,882	**18,122,604**
Commercial	81,471	2,456,836	49,729	1,809,298	**4,397,334**
Industrial	99,458	1,777,556	112,155	2,078,047	**4,067,216**
Public	16,929	835,874	7,406	393,602	**1,253,811**
Autos	20,103	836,932	0	0	**857,035**
Total	**529,033**	**14,663,775**	**480,363**	**13,024,829**	**28,698,000**

Development is expected to continue within the study area, which could increase the number of structures and people at risk of flooding. These expectations are supported by the Stockton, Lathrop and Manteca General Plans, which specifically identify planned development, including infill of previously developed urban areas as well as conversion of agricultural lands to urban land use. Such development in RD 17 potentially doubles the number of structures at risk and increases population risk by 45,000 to 50,000 persons based on adopted and approved land use plans. It is unknown whether or not development and population growth would meet these projections during the 50-year planning horizon for this study and what effect the passage of SB 5 will have on these growth estimates.

2.1.2 OPPORTUNITIES

Opportunity: Improve FRM in the study area.

There is an opportunity to reduce the risk to public safety and flood damages from the Calaveras and San Joaquin Rivers, Mosher Slough and the Delta.

Opportunity: Sustain and improve aquatic, riparian and adjacent terrestrial habitats in conjunction with FRM features.

There is an opportunity to sustain and improve floodplain habitats along existing water courses in conjunction with FRM features.

Opportunity: Integration with other Federal, State and local initiatives.

There is an opportunity to integrate a proposed project with other watershed-level initiatives for a holistic approach to FRM, ER and navigation in the San Joaquin River watershed.

Opportunity: Educate the public about residual flood risk.

There is an opportunity to expand current programs and continue to educate the public about ongoing residual flood risk.

2.2 OBJECTIVES AND CONSTRAINTS

2.2.1 FEDERAL OBJECTIVES

In the Flood Control Act of 1970, Congress identified four equal national objectives in water resources development planning. These objectives are: NED, Regional Economic Development (RED), Environmental Equality (EQ) and Social Wellbeing and Other Social Effects (OSE). These four categories are known as the System of Accounts, whereby each proposed plan can be easily compared to the no action plan and other alternatives. The Federal objective identified in the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies (Principles and Guidelines) of February 3, 1983 (42 U.S.C. 1962 a-2 and d-1), is:

"The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable Executive Orders and other Federal planning requirements."

2.2.2 NON-FEDERAL OBJECTIVES

The NFS objective is to identify and evaluate FRM alternatives to determine an implementable plan, in cooperation with USACE, to reduce the flood risk to people, property and infrastructure. SB 5 requires the sponsor to identify, develop, and construct a plan that will perform at a level sufficient to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources.

2.2.3 PLANNING OBJECTIVES

The national objective to contribute to NED is a general statement and not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified are refined and stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the without-project conditions. Each of the planning objectives applies to the study area for the 50-year period of analysis, except where stated otherwise. The planning objectives are as follows:

- Reduce risk to property and infrastructure due to flooding in Stockton, Lathrop and Manteca (NED Account);
- Reduce flood risk to public health, safety and life in Stockton, Lathrop and Manteca (OSE Account);
- Minimize residual flood risks to the extent justified; and
- Incorporate environmentally sustainable design principles during development and analysis of FRM plan components.

2.2.4 PLANNING CONSTRAINTS

Planning constraints represent restrictions that are important to various stakeholders. Some constraints are absolute and represent restrictions that should be observed (e.g., existing regulations and law). Other constraints are more flexible and can be incorporated into the tradeoff analysis. The planning constraints are:

- Minimize significant adverse impacts to the human environment; and
- Comply with applicable Federal laws, regulations and policies.

2.3 INVENTORY AND FORECAST OF FUTURE WITHOUT PROJECT CONDITIONS

The future without-project (FWOP) is the most likely condition expected to exist in the future in the absence of a proposed water resource project. The FWOP defines the benchmark against which the alternative plans are evaluated. While most of the documentation of the inventory and forecast of affected resources is located in Chapter 5, a few critical assumptions that affect plan formulation are highlighted in this section. Critical assumptions in defining the FWOP conditions include:

- Residents of Stockton, Lathrop and Manteca will continue to live in historically modified floodplain areas and be at risk of flood events.
- There are three populations at risk in the study area:
    - Population flooded: 235,000 (within 500-year floodplains for all at-risk areas).
    - Regional Population Affected: 696,000 (Stockton Metro Area, 2011 estimate).
    - Total Population Potentially Affected: Approximately 25 million (includes Stockton Metro Area and Delta Export Service Area[1]) and three million acres of farmland.
- Historical events indicate that geotechnical failures within the study area are occurring and will occur in the future due to seepage.
- Levee maintenance will be covered under existing O&M manuals and will be brought into compliance with those requirements using a System Wide Improvement Framework.
- The following ongoing Sponsor projects will be constructed prior to the period of analysis for this study:
    - RD 404 cutoff wall to address seepage issues in the levee in Boggs Tract; and
    - RD 17 Phases 1-3 to remedy levee seepage (detailed in Section 5.23.3)
- FWOP conditions include the impacts of sea level rise due to climate change, which is expected to reduce the level of performance of some existing levees. Due to the uncertainty in changes of inland hydrology (peak runoff) due to climate change, the report includes a qualitative description of potential impacts.
- Future development will occur in compliance with FEMA regulations, SB 5 and other local land-use planning rules and regulations.

2.3.1 EXISTING NON-STRUCTURAL FEATURES

There are several small flood risk management features that were constructed by private landowners or local or regional governments to reduce the consequences of flooding in the study area. These features include small berms, diversion structures and drainage canals. It is assumed that all of these features will remain in place under the FWOP condition.

[1] "The Delta Service Area is defined as those areas of the state outside the Delta that receive water from the State Water Project or the Central Valley Project, either directly or by exchange, by means of diversions through the Sacramento San Joaquin Delta.

CHAPTER 3 — PLAN FORMULATION

The formulation, evaluation and comparison of alternative plans comprise the third, fourth and fifth steps of the USACE planning process, referred to collectively as Plan Formulation. Plan Formulation is a structured and highly iterative process to develop and refine a reasonable range of alternative plans, then narrow down to a final array of feasible plans, from which a single plan may be recommended for authorization and implementation.

3.1 MEASURES

A measure addresses one or more planning objectives. Table 3-1 lists the preliminary management measures identified indicates the objectives to which they contribute. The measures were screened to determine whether each should be retained for use in the formulation of alternative plans (Table 3-2).

These measures primarily achieve FRM objectives in the study area. Some measures may also contribute to environmental quality objectives through sound environmental design of the project. FRM measures can be non-structural or structural. Non-structural measures reduce flood damages without altering the nature or extent of flooding and- are accomplished by changing the use of the floodplains or by adapting existing uses to the flood hazard. In contrast, structural measures alter the nature or extent of flooding by modifying the magnitude, duration, extent or timing of flooding.

When considering opportunities to apply FRM measures in the study area, an understanding of the basic magnitude of costs to construct the measures is useful when compared to the maximum potential FRM benefits possible. Reduction in flood damages translates into monetary benefits, which in turn help determine if the Federal government can participate in a project (i.e., the Federal interest).

Table 3-1: Initial Screening of Management Measures

General Measures	Objectives			
	Reduce Flood Risk	Reduce Flood Damages	Implement Sustainable Environmental Design	Minimize Residual Risk
Flood Warning, Emergency Evacuation Plan	X	X		X
Floodplain Management	X	X		X
Elevate Critical Infrastructure	X	X		X
Ring Levees for Critical Infrastructure	X	X		
Elevate/Relocate/Buy Out Structures	X	X		X
Levee Raise	X	X		
Cutoff Wall	X	X		
Deep Soil Mixing (Seismic)	X	X		X
Setback Levee	X	X	X	
Seepage/Stability Berm	X	X		
Erosion Protection				X
Bridge Modification for Conveyance	X	X		
Upstream Bypass	X	X		
Channel Modification for Conveyance	X	X	X	
Bypass Channels	X	X	X	
Control Structure	X	X		
Levee Extension	X	X		X
Closure Structure	X	X		X
Improve Existing Levee	X	X	X	
Reservoir Reoperation	X	X		
Additional Reservoir Storage	X	X		
Additional Transitory Floodplain Storage	X	X		

Table 3-2: Summary of Management Measures Retained or Dropped

Measures	Retained	Dropped	Reason for Elimination
Non-Structural Measures			
Flood Warning, Emergency Evacuation Plan	X		
Floodplain Management	X		
Elevate Critical Infrastructure		X	Not cost effective.
Ring Levees for Critical Infrastructure		X	Not cost effective. Critical infrastructure would be inaccessible during flood events.
Elevate/Relocate/Buy Out Structures		X	Not cost effective.
Structural Measures			
Levee Raise	X		
Cutoff Wall	X		
Deep Soil Mixing (Seismic)	X		
Setback Levee	X		
Seepage/Stability Berm	X		
Erosion Protection	X		
Bridge Modification for Conveyance	X		
Upstream Bypass		X	Not cost effective. Does not adequately address flood risk where most needed.
Channel Modification for Conveyance	X		
Bypass Channels	X		
Control Structure	X		
Levee Extension	X		
Closure Structure	X		
Improve Existing Levee	X		
Reservoir Reoperation		X	Not cost effective. Reoperation or expansion of reservoirs would require 1,000,000 acre-feet of additional storage capacity to be effective.
Additional Reservoir Storage		X	Outside the scope of the study.
Additional Transitory Floodplain Storage		X	Previous analysis shows this would result in negligible changes in flood stages within the study area.

3.2 FORMULATION AND EVALUATION OF INITIAL ALTERNATIVE PLANS

3.2.1 FORMULATION STRATEGY

An initial array of FRM alternative plans was developed, evaluated and compared to identify a plan that reasonably maximizes the net benefits (benefits minus costs). The alternatives were formulated to address specific flooding sources using measures to reduce the consequences to the maximum extent possible. This initial array of FRM alternative plans primarily consists of various levee improvement configurations, developed on the assumption that the North and Central Stockton and RD 17 areas are hydraulically separable.

The retained measures generally need to be combined with other retained measures in order to develop complete alternative plans. Table 3-3 illustrates which measures were combined to form the various alternative plans. Descriptions and figures illustrating the initial alternatives are located in Appendix B: Engineering. In the table, NS refers to North Stockton; CS refers to Central Stockton and RD17 refers to RD 17 for the geographic location of the alternative. MCB refers to Mormon Channel Bypass and PCB refers to Paradise Cut Bypass.

Table 3-3: Inclusion of Measures in Initial Alternative Plans

Measure → Alternative ↓	Flood Warning, Emergency Evacuation Plan	Floodplain Management	Levee Raise	Cutoff Wall	Deep Soil Mixing (Seismic)	Setback Levee	Seepage/Stability Berm	Erosion Protection	Bridge Modification for Conveyance	Channel Modification for Conveyance	Bypass Channels	Control Structure	Levee Extension	Closure Structure	Improve Existing Levee
NS-A	X	X		X	X			X						X	X
NS-B	X	X	X	X	X			X						X	X
NS-C	X	X		X	X			X						X	X
NS-D	X	X		X	X										X
NS-E	X	X		X											X
NS-F	X	X	X	X	X			X						X	X
CS-A	X	X		X											X
CS-B	X	X		X										X	X
CS-C	X	X		X											X
CS-D	X	X	X	X										X	X
CS-E	X	X		X											X
CS-F	X	X	X	X										X	X
CS-G	X	X							X	X	X	X			
RD17-A	X	X		X											X
RD17-B	X	X		X			X								X
RD17-C	X	X		X				X							X
RD17-D	X	X		X		X	X	X							X
RD17-E	X	X	X	X		X	X	X					X		X
RD17-F	X	X		X											X
RD17-G	X	X	X	X		X	X	X					X		X
PCB	X	X		X		X				X	X				X

3.3 INITIAL ALTERNATIVES ANALYSIS

Alternatives for each area were analyzed by using a modification of the Parametric Cost Estimation Tool (PCET) developed for the Sutter Basin Feasibility Study by URS, Inc. The PCET tool was proven as a reliable estimator for the costs of levee construction and repairs. Potential environmental mitigation costs for each reach were included in the estimates, as well as potential real estate acquisition costs for landside right-of-way or easement from the existing levee landside toe. This allowed use of inventory data for the areas, including population, number of structures and counts of critical infrastructure for comparisons. Critical infrastructure is defined as public structures where any risk of flooding is too great, such as hospitals, nursing homes, jails, fire and police stations and schools. Residual floodplains were modeled to determine effect of the alternatives.

Using the information described above, USACE and the sponsors determined the annual and net benefits effectively representing economic performance of an alternative. Life safety or the ability of an alternative to reduce risk to population from residual flood damages was ranked on a scale ranging from poor to excellent. Alternatives were briefly analyzed relative to compliance with EO 11988. Floodplain Management and the North and Central Stockton areas were preliminarily determined to have met the intent of EO 11988 due to the built-out nature of the areas; RD 17 has planned development which makes it difficult to comply with the EO 11988 guidance; Mormon Channel meets goals of EO 11988 through the ER benefits that could be realized. See section 3.6 for the detailed EO 11988 analysis.

The team used existing information to evaluate the economic benefits of the Paradise Cut setback alternatives. A series of incremental improvements were evaluated and modeled by MBK Engineers for the River Islands development project (MBK, 2008). The observed decrease in efficiency as the project size increases is consistent with the hydraulic limitations presented by the downstream stage boundary being within the tidal region of the Delta.

To reduce to a reasonable range of alternatives to be carried forward into a focused array, only the two alternatives for each area that maximized net benefits were carried forward. For RD 17, only one alternative, RD17-E, was shown to have positive net benefits and provide reduced risk. Of the bypass alternatives, Mormon Channel has positive net benefits and was carried forward. The Paradise Cut Bypass alternative was not carried forward, as it is not cost effective and brings about concerns regarding downstream impacts of widening the bypass.

In compliance with USACE ER 11-1-321, a Value Engineering study was held July 22-26, 2013. USACE and the NFS used the initial alternatives in order to develop composite alternatives to be analyzed and identify a recommended plan.

Table 3-4 summarizes the alternatives carried forward into development of the focused array of alternatives. The *Critical Structures Benefiting from Reduced Flood Risk* column denotes the number of critical structures (hospitals, police and fire stations, etc.) with reduced flood risk resulting from the alternative with a 90% assurance at a 1% ACE event.

Table 3-4: Initial Alternatives Retained

Alternative	Annual Benefits ($1,000s)	Net Benefits ($1,000s)	Life Safety	Critical Structures Benefiting from Reduced Flood Risk
NS-B Delta Front North and South and Calaveras River	72,000	53,000	Very Good	0
NS-F Delta Front North and South and Full Calaveras River	76,000	54,000	Excellent to Very Good	0
CS-D Calaveras River, Diverting Canal and San Joaquin River	69,000	56,000	Excellent to Very Good	0
CS-F Calaveras River and San Joaquin River	56,000	46,000	Good	5
CS-G Mormon Channel Bypass	13,000	11,000	Fair	134
RD17-E SJR North with Tieback and Extension	27,000	12,000	Excellent to Very Good	51

3.4 FOCUSED ARRAY OF ALTERNATIVES

The strategy to move the initial array of alternative plans forward included: (1) applying metrics to the initial array of alternatives; (2) selecting the best alternatives for each separable area or levee reach based on parametric cost and benefit analysis; (3) and combining the best alternatives into an alternative to be carried forward. Alternatives were formulated using ER 1100-2-8162, Incorporating Sea Level Changes in Civil Works Programs, curve two to account for sea-level change over the design life of the project. A sensitivity analysis was also conducted. Using the nomenclature and basic alternatives presented in the Alternatives Milestone meeting, USACE, SJAFCA and DWR developed a focused array of alternatives.

All of the alternatives except Alternative 10 include an extension of the RD 17 tie-back levee and were designed to pass a 0.5% ACE flood with 90% assurance. It was estimated that only a few short reaches of levee required height increases to pass a 0.5% ACE event with 90% assurance and incremental benefits would exceed the incremental cost. Therefore, alternatives attaining lower levels of performance were not formulated. Levels of performance greater than the 90% assurance of passing a 0.5% ACE flood were not developed due to a lack of sponsor interest in a more expensive plan. The performance of Alternative 10 was not able to obtain the same performance of the other alternatives because the existing RD 17 tie-back levee was found to be outflanked for floods larger than 1% ACE. The floodwaters that outflanked the tie-back levee would result in higher stages (relative to the other alternatives) along the right bank of French Camp Slough.

Table 3-5 summarizes the focused array of alternatives. Descriptions and figures showing the proposed alignments of the focused array of alternatives are on the following pages.

Table 3-5: Focused Array of Alternatives

Name	Increments	Description
Alternative-1 – No Action	None	No Action
Alternative-2A – Delta Front and Mainstem Levees	NS-F, CS-D, RD17-E	Levee Improvements, Closure Structures, No Bypass, with Stockton Diverting Canal
Alternative-2B – Delta Front and Mainstem Levees	NS-B, CS-F, RD17-E	Levee Improvements, Closure Structures, No Bypass
Alternative-4 Delta Front and Mainstem Levees and Mormon Channel Bypass	NS-B, CS-F, RD17-E, CS-G	Levee Improvements, Closure Structures, Mormon Channel Bypass
Alternative-7 – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements	Alternative 2B + Raise	Levee Improvements, Closure Structures, No Bypass, Levee Raises
Alternative-8 – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements	Alternative 2A + Raise	Levee Improvements, Closure Structures, No Bypass, with Stockton Diverting Canal, Levee Raises
Alternative-9 – Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass	Alternative 4 + Raise	Levee Improvements, Closure Structures, Mormon Channel Bypass, Levee Raises
Alternative-10 – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements	Alternative 8 w/o RD 17 + Raise	Levee Improvements, Closure Structures, No Bypass, with Stockton Diverting Canal, Levee Raises

Notes:
1. A now obsolete Alternative 3 was comprised of SB 5 levee raise measures that are included Alternatives 7, 8, 9, and 10.
2. Alternative 5, Urban Flood Risk Reduction/Cross Levees was not economically justified and was dropped from further analysis.
3. A non-structural Alternative 6 was eliminated as being un-implementable due to high cost of flood-proofing, relocating, or raising structures.
4. Some non-structural measures can be included in all alternatives (i.e., Flood Warning, Emergency Evacuation Plan (FWEEP), Floodplain Management).

The resulting focused array of alternatives is described as follows:

Alternative 1 (No Action): This would include no Federal action. There are locally sponsored activities ongoing and potential for other local or State sponsored projects that could be undertaken without Federal participation. It is expected that current FRM structures would be maintained and residual risk of flood damages would remain.

Alternative 2A: This combines the following alternatives to arrive at a comprehensive solution: North Stockton Alternative F, Central Stockton Alternative D and RD 17 Alternative E (Figure 3-1). It would implement levee improvements without implementing Mormon Channel bypass. Levee improvements would be to the authorized design flow and the extent of levee repairs would be approximately 53.1 miles (280,600 feet).

Alternative 2B: This combines the following alternatives: North Stockton Alternative B, Central Stockton Alternative F and RD 17 Alternative E (Figure 3-2). It would implement levee improvements without implementing Mormon Channel bypass. Levee improvements would be to the authorized design flow and the extent of levee repairs would be approximately 42.5 miles (224,400 feet).

Alternative 4: This includes levee raises to meet SB 5 height requirements. The components of this plan are: North Stockton Alternative B, Central Stockton Alternative F, RD 17 Alternative E and the Mormon Channel Bypass (Figure 3-3). It would implement levee improvements along with restoration of the Mormon Channel, including a diversion control structure at the Stockton Diverting Canal. The estimated extent of levee repairs would be 42.5 miles (224,400 feet) plus 6.3 miles (33,400 feet) of channel work for the Mormon Channel portion.

Alternative 7: This combines North Stockton Alternative B, Central Stockton Alternative F and RD 17 Alternative E (Figure 3-4). It would implement levee improvements without implementing Mormon Channel bypass, combining the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm in RD 17 and levee geometry improvements. It would address projected Sea Level Change (SLC) by including raises in levee height where needed. There would also be 2.2 miles of new levee constructed to extend the RD 17 tie-back levee and the secondary levee at the Old River flow split. The new levees would include a cutoff wall to address potential seepage issues.

Alternative 8: This combines the following alternatives: North Stockton Alternative F, Central Stockton Alternative D and RD 17 Alternative E (Figure 3-5). It would implement levee improvements without implementing Mormon Channel bypass, combining the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm and levee geometry improvements. It would address projected SLC by including raises in levee height where needed. There would also be 2.2 miles of new levee constructed to extend the RD 17 tie-back levee and the secondary levee at the Old River flow split. The new levees would include a cutoff wall to address potential seepage issues.

Alternative 9: This combines the following alternatives: North Stockton Alternative B, Central Stockton Alternative F, RD 17 Alternative E and the Mormon Channel Bypass (Figure 3-6). It would implement levee improvements along with restoration of the Mormon Channel including a diversion control structure at the Stockton Diverting Canal. This alternative combines the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm and levee geometry improvements. It would address projected SLC by including raises in levee height where needed. There would also be 2.2 miles of new levee constructed to extend the RD 17 tie-back levee and the secondary levee at the Old River flow split. The new levees would include a cutoff wall to address potential seepage issues. The diversion control structure for Mormon Channel at the Stockton Diverting Canal would consist of pipe culverts with gates to control releases to a maximum flow of 1,200 cfs to Mormon Channel.

Alternative 10 – North and Central Stockton: This combines the following alternatives: North Stockton Alternative F and Central Stockton Alternative D (Figure 3-7). It would implement levee improvements without implementing Mormon Channel bypass. This alternative combines the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm and levee geometry improvements. It would address projected SLC by raising levee height where needed. The proposed levee improvements are comparable to Alternative 8, with the exception of the RD 17 components, which are not included.

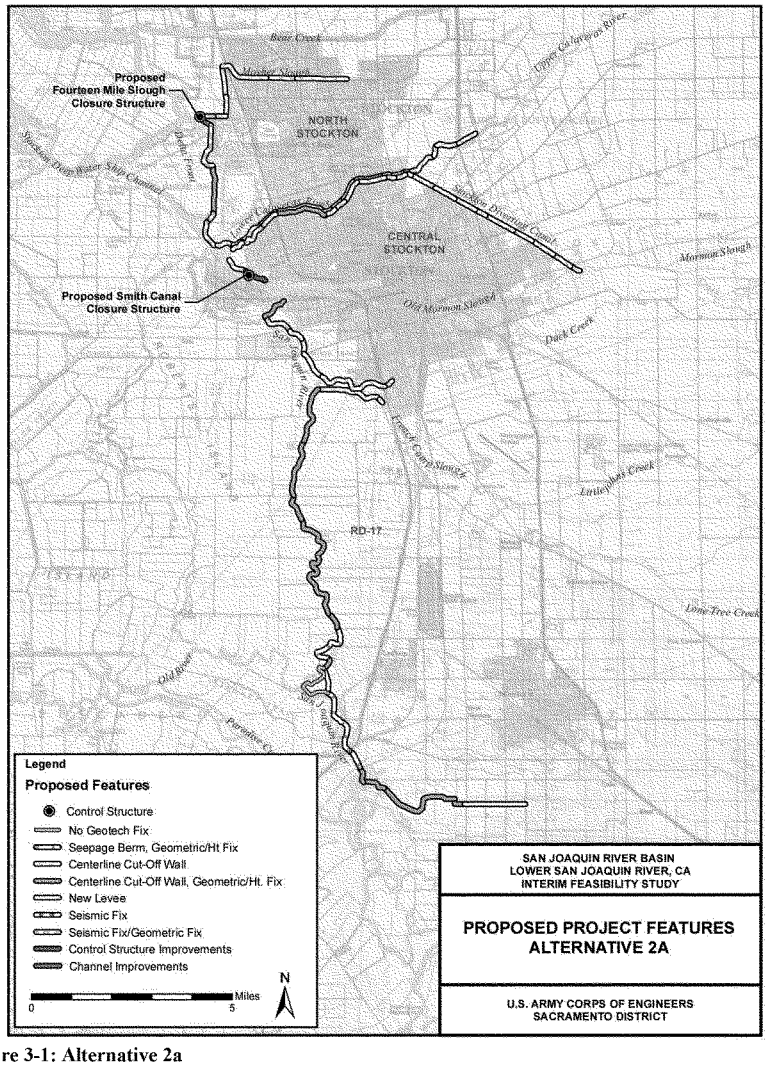


Figure 3-1: Alternative 2a

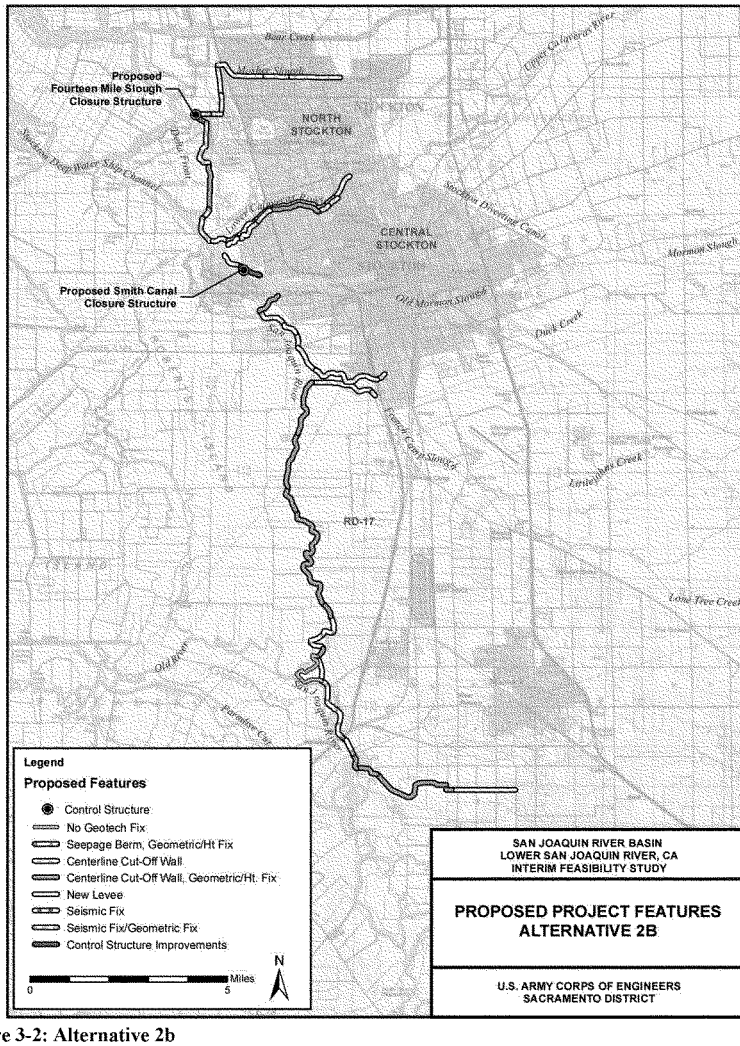


Figure 3-2: Alternative 2b

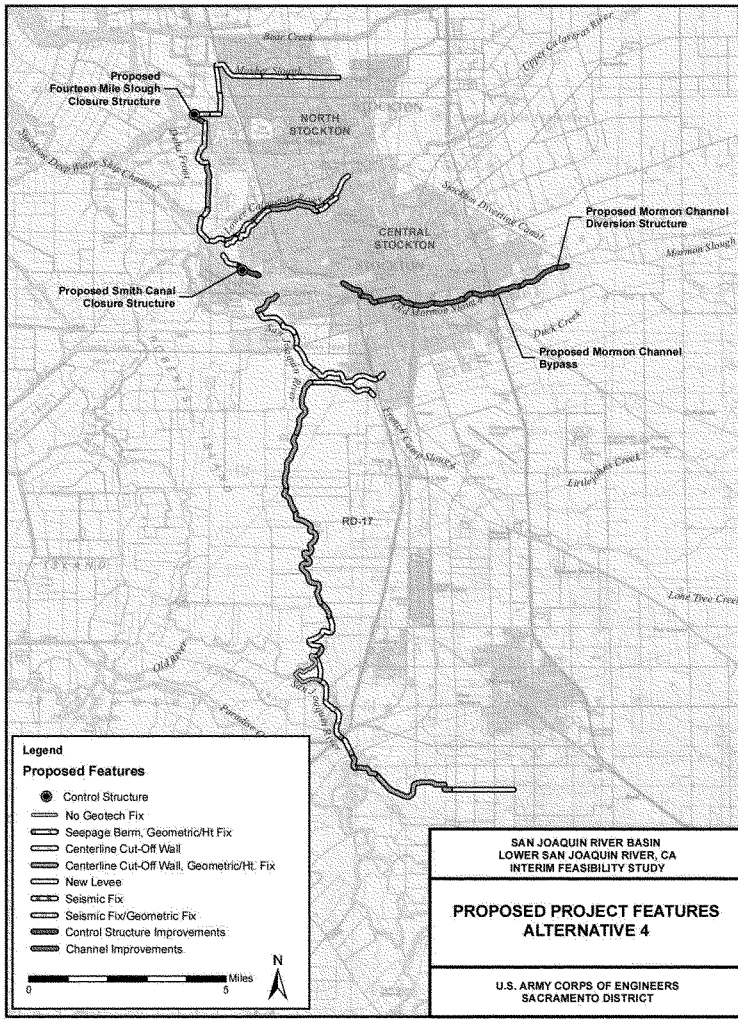


Figure 3-3: Alternative 4

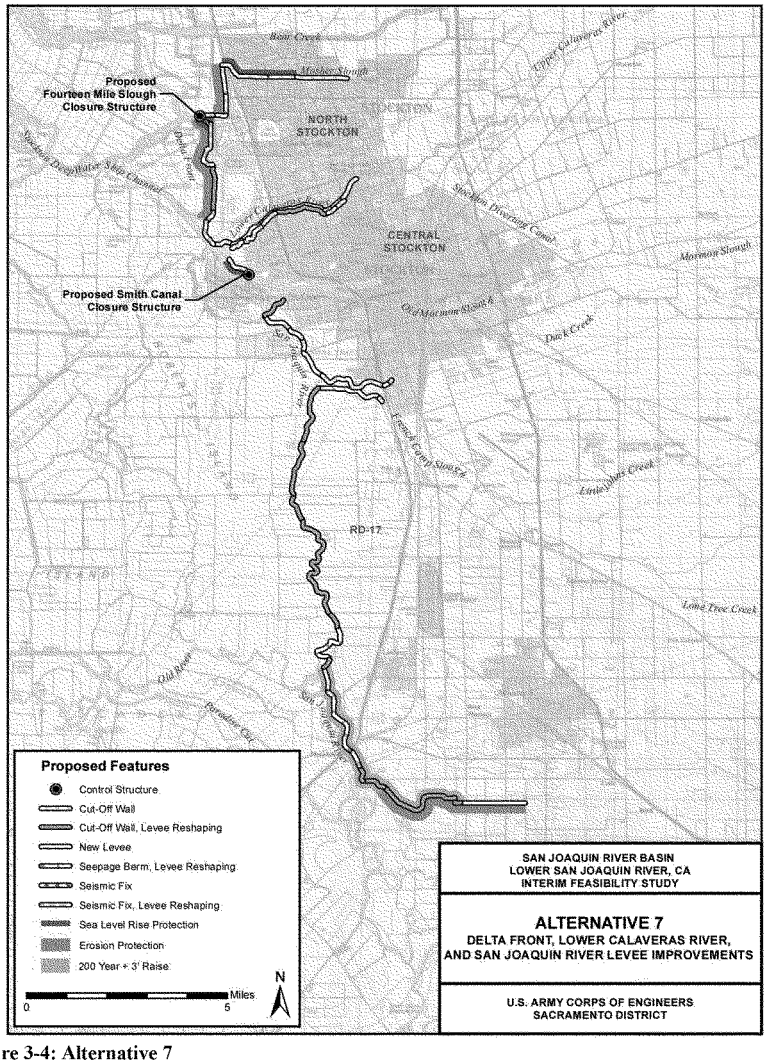


Figure 3-4: Alternative 7

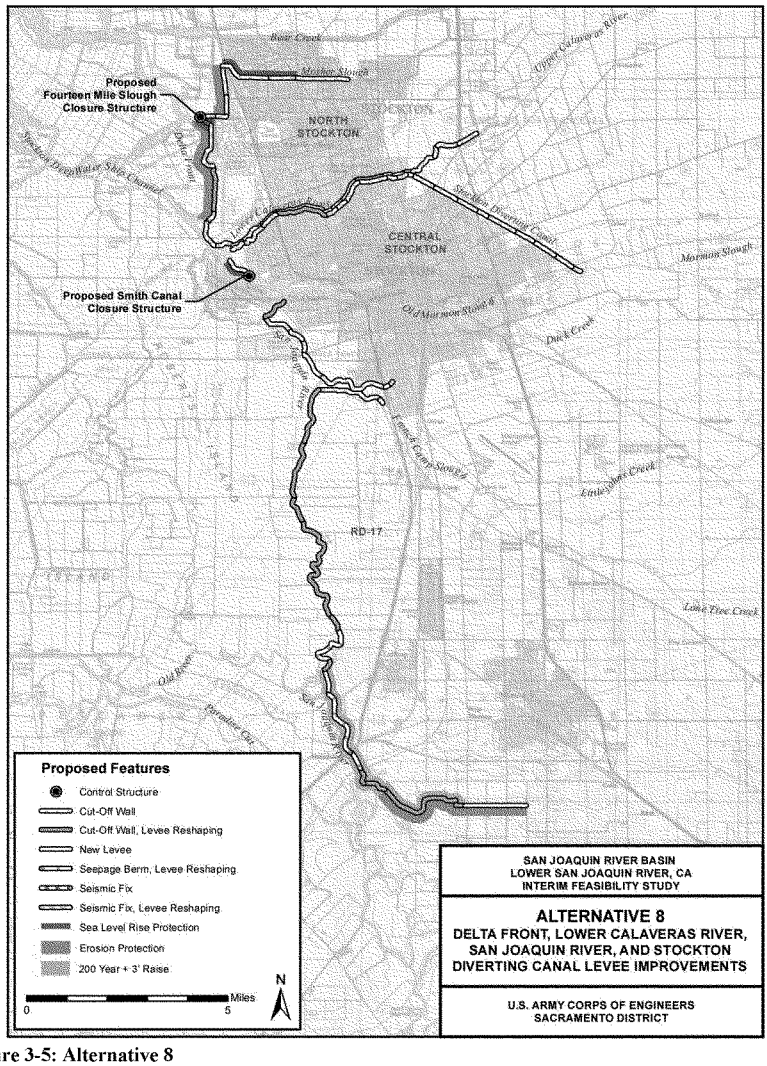


Figure 3-5: Alternative 8

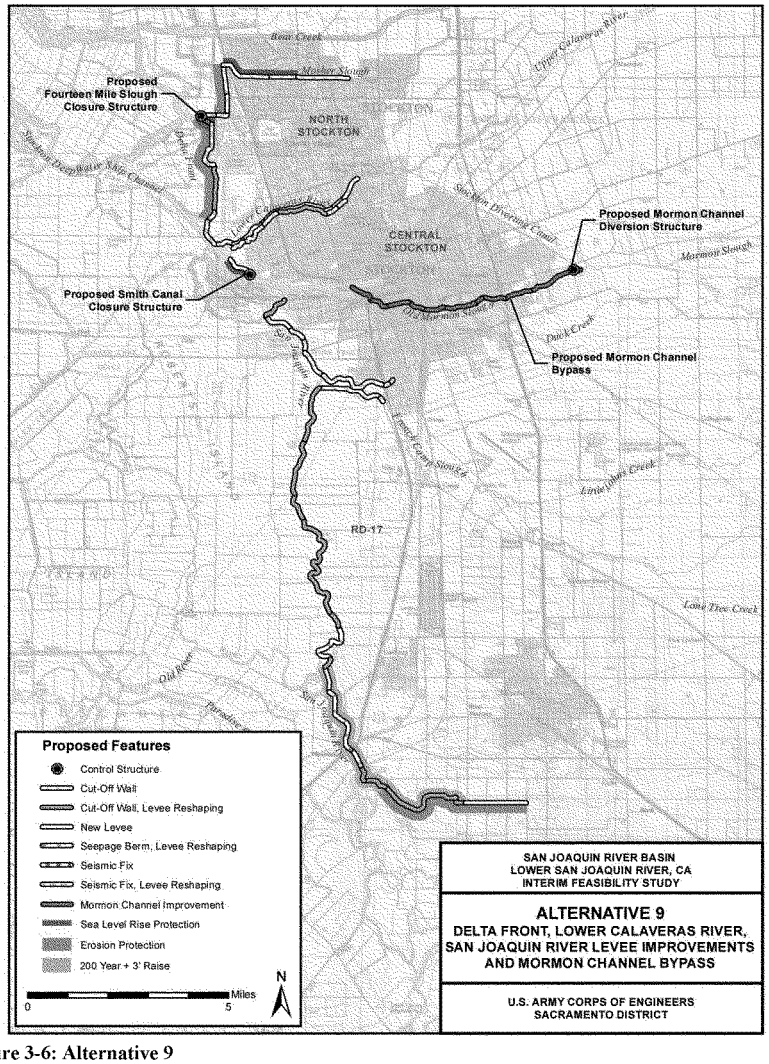


Figure 3-6: Alternative 9

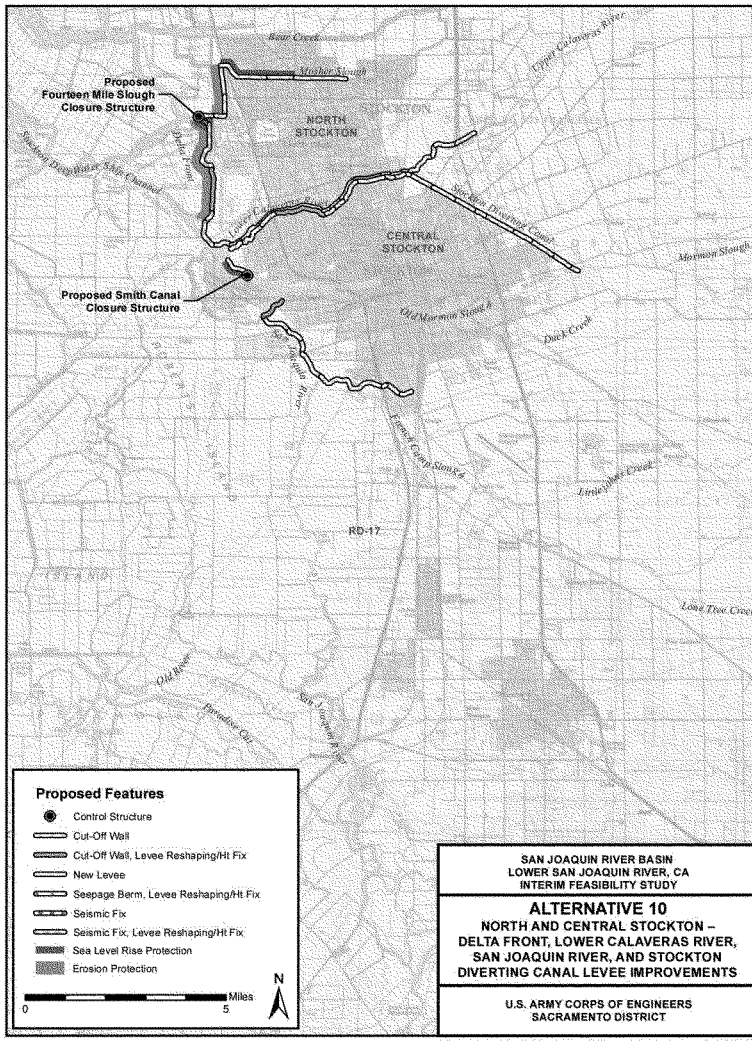


Figure 3-7: Alternative 10

3.5 COMPARISON OF FINAL ARRAY OF ALTERNATIVE PLANS AND DECISION CRITERIA

In addition to refining the alternatives, modified versions of Alternative 7 and Alternative 9 were added to the final array for compliance with EO 11988. These modified alternatives did not include improvements in RD 17. The alternatives previously referred to as Alternatives 7 and 9 were reclassified as Alternatives 7b and 9b, respectively. The modified versions with RD 17 removed were classified as Alternatives 7a and 9a. For consistency in nomenclature, Alternative 8 was reclassified as Alternative 8b, and Alternative 10 (Alternative 8 without RD 17 improvements) was reclassified as Alternative 8a.

During further analysis of the focused array of alternatives, analysis for potential relative Sea Level Change (SLC), was conducted, in accordance with USACE ER 1100-2-8162, Incorporating Sea Level Changes in Civil Works Programs (31 December 2013). The alternatives were compared following the method described in Section 6.d (1). Curve two under the cited guidance was used in the future hydrology to account for estimated SLC. The alternatives include a subset that was scaled to provide a 0.5% level of performance without SLC (2A, 2B, 4) and a paired subset that was scaled to account for estimated SLC (7a, 8a, 9a, 7b, 8b, 9b). The alternatives were otherwise equivalent.

The alternatives that were scaled to provide 0.5% ACE, including future SLC, provided greater net benefits than alternatives scaled to provide a 0.5% level of performance under existing conditions. Alternatives 2A, 2B and 4 were removed from further consideration, based on this information. The last step of the method in Section 6.d (1) of ER 1100-2-8162 is to evaluate the performance of the selected alternative to other rates of SLC. This evaluation was conducted after selection of the Recommended Plan (RP).

Table 3-6 describes the final array of alternatives. Figures 3-8 through 3-13 display the features of each alternative.

Table 3-6: Final Alternative Descriptions

Name	Description
Alternative 1 – No Action	No Action
Alternative 7a – North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements excluding RD 17	Levee Improvements, Closure Structures, No Bypass, Levee Raises, New Levee
Alternative 7b – North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements including RD 17	Levee Improvements, Closure Structures, No Bypass, Levee Raises, New and Setback Levees
Alternative 8a – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements excluding RD 17	Levee Improvements, Closure Structures, No Bypass, with Diverting Canal, Levee Raises, New Levee
Alternative 8b – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements including RD 17	Levee Improvements, Closure Structures, No Bypass, with Diverting Canal, Levee Raises, New and Setback Levees
Alternative 9a – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass excluding RD 17	Levee Improvements, Closure Structures, Mormon Channel Bypass, Levee Raises, New Levee
Alternative 9b – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass including RD 17	Levee Improvements, Closure Structures, Mormon Channel Bypass, Levee Raises, New and Setback Levees

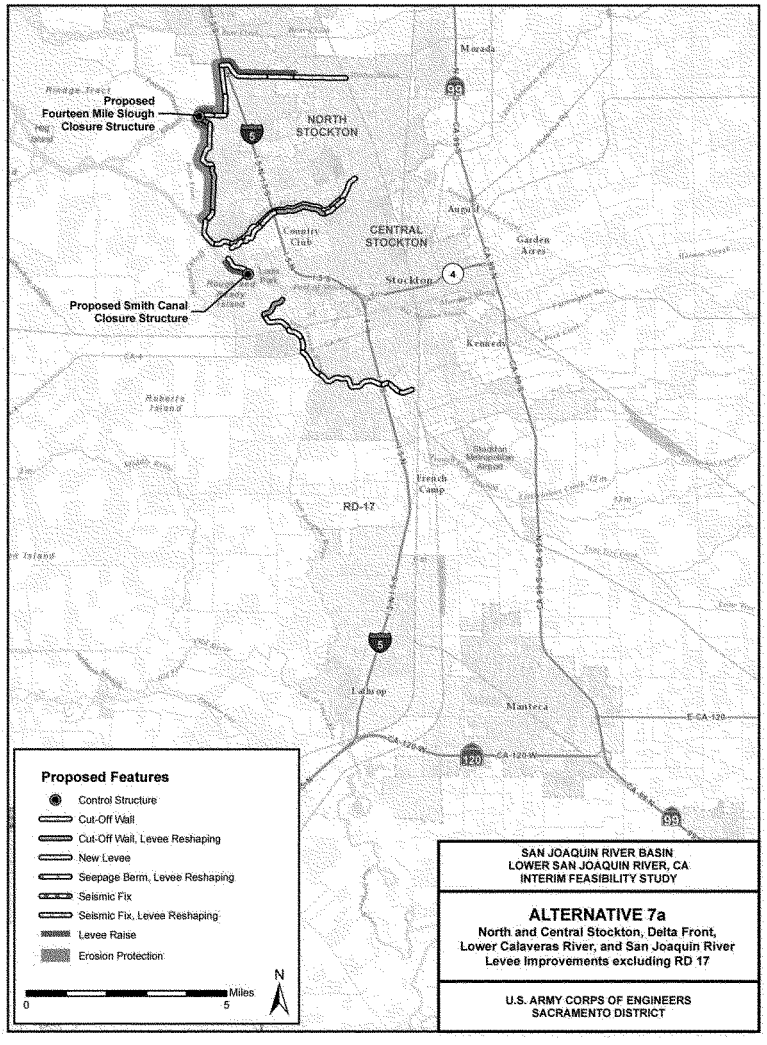


Figure 3-8: Alternative 7a

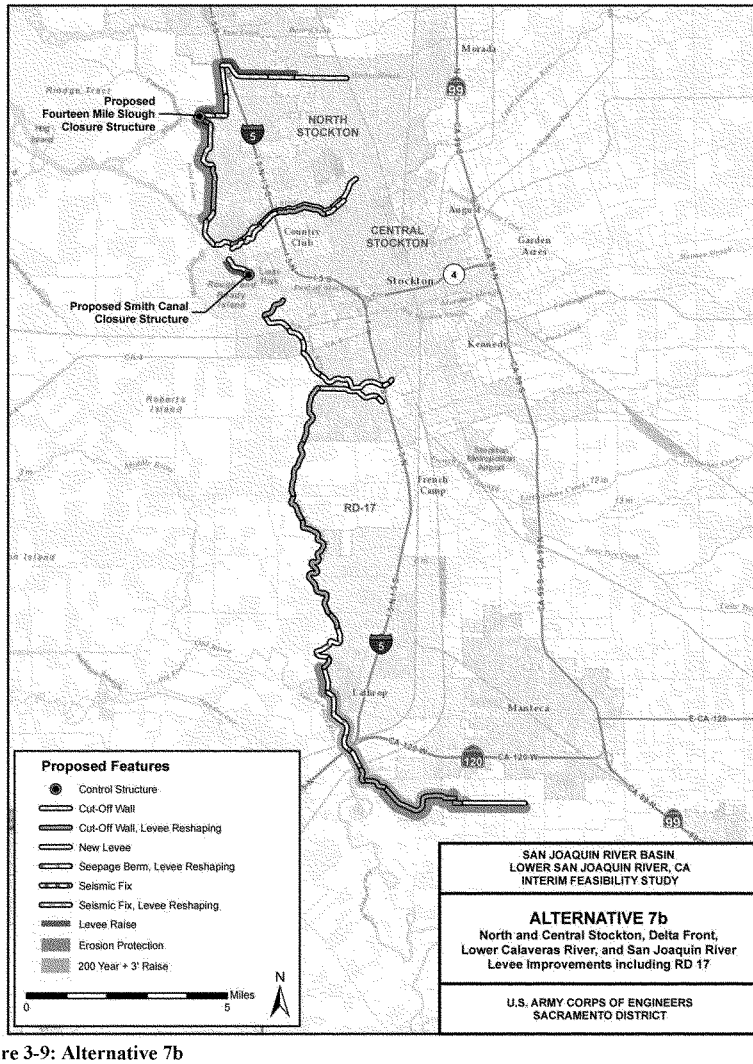


Figure 3-9: Alternative 7b

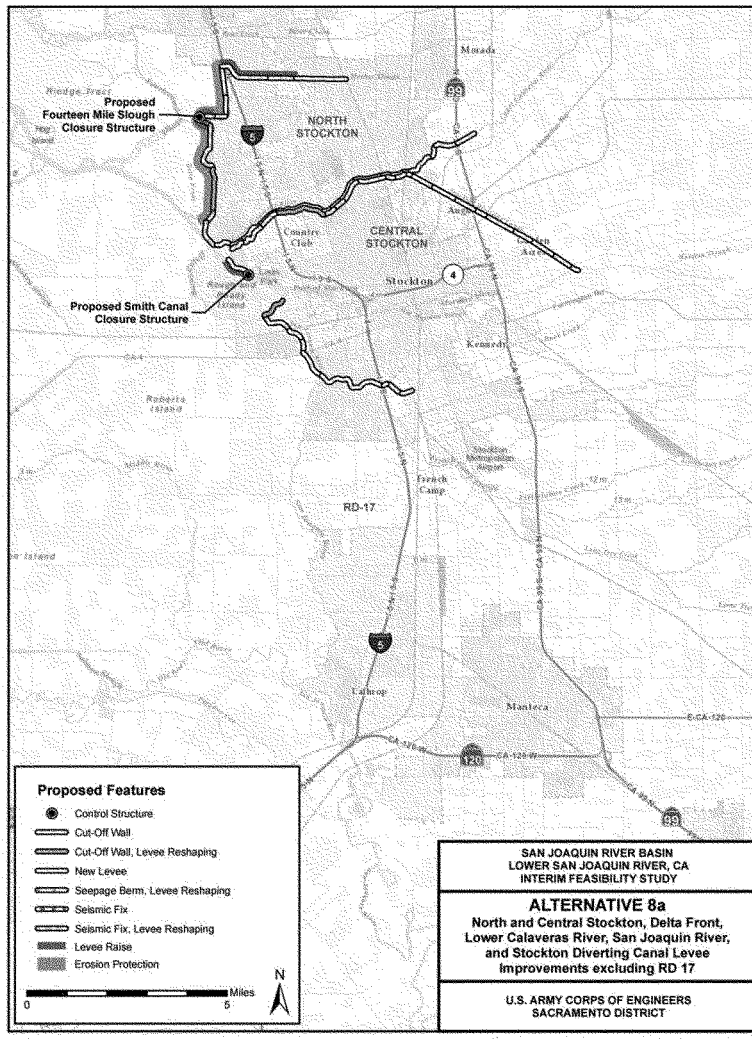


Figure 3-10: Alternative 8a

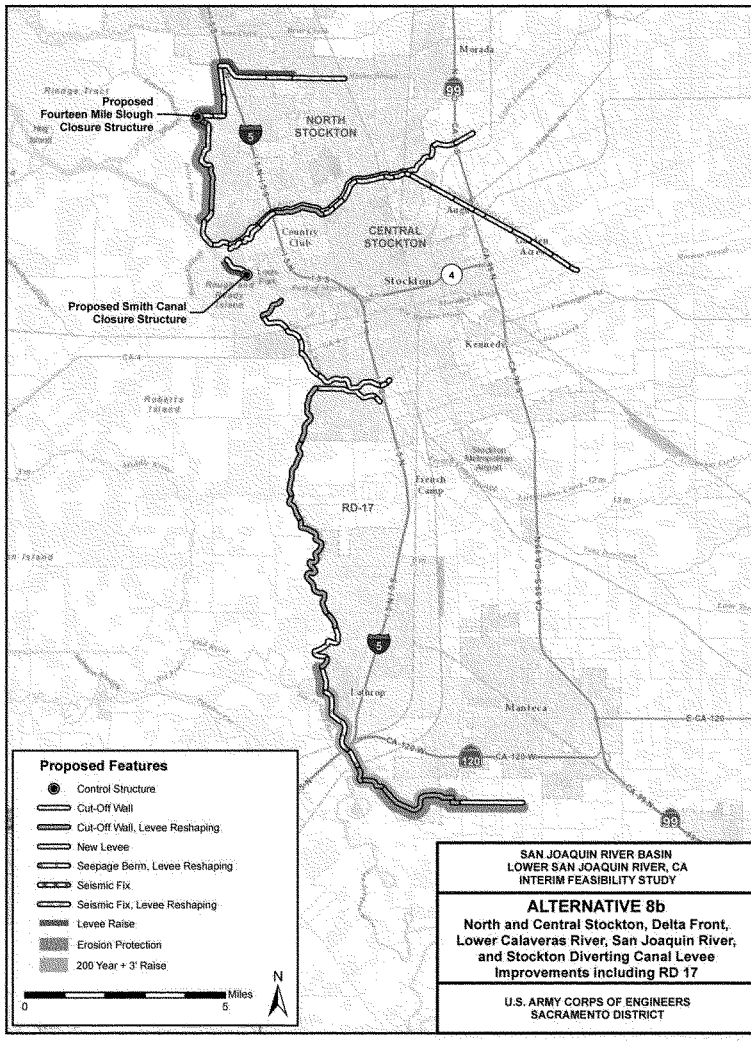


Figure 3-11: Alternative 8b

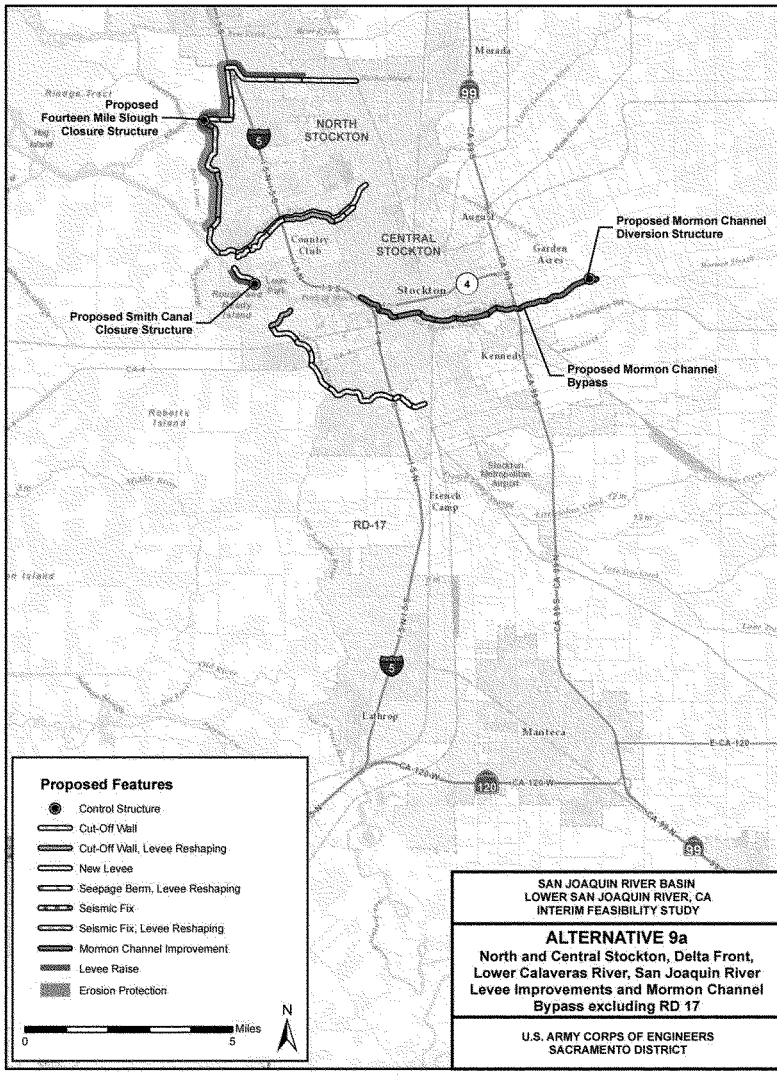


Figure 3-12: Alternative 9a

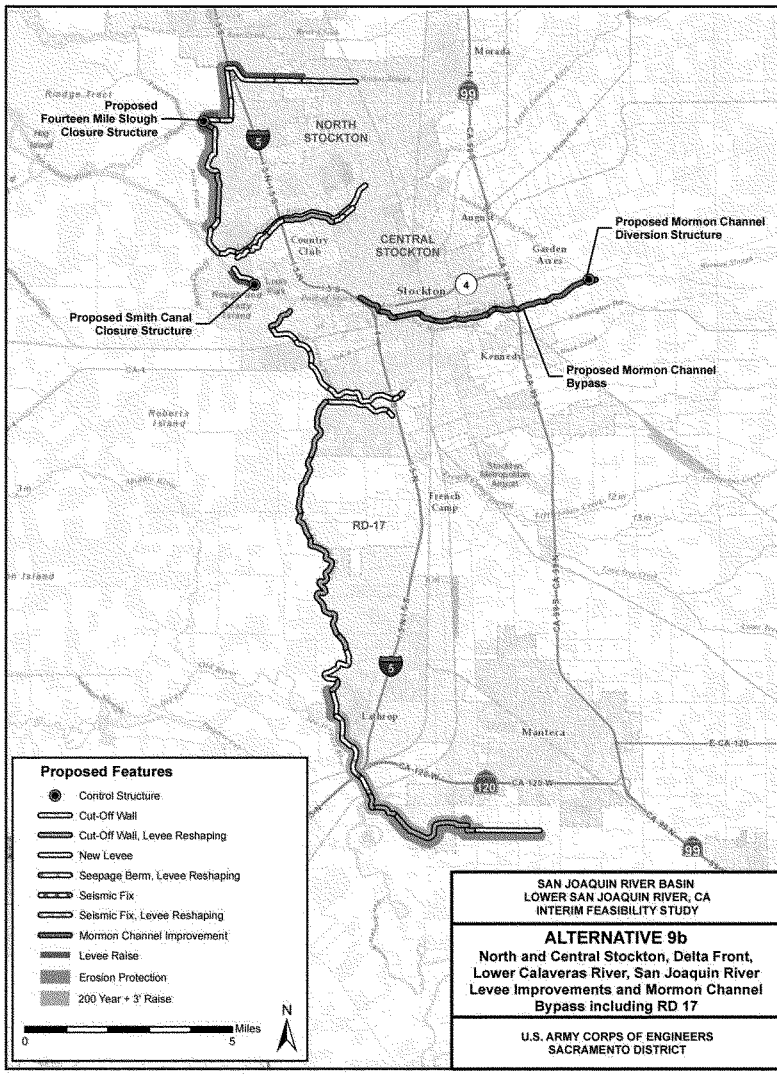


Figure 3-13: Alternative 9b

Table 3-7 demonstrates the effectiveness of the alternatives in meeting the planning criteria defined by the Principles and Guidelines. The criteria are defined:

- **Completeness** – "Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective."
- **Effectiveness** – "Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities."
- **Efficiency** – "Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment."
- **Acceptability** – "Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations and public policies."

Table 3-7: Planning Criteria Analysis for Final Alternatives

Final Alternatives	Completeness	Effectiveness	Efficiency	Acceptability
Alternative 1 – No Action	No	No	No	No
Alternative 7a – North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements excluding RD 17	Yes	Yes	Yes	Yes
Alternative 7b – North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements including RD 17	Yes	Yes	Yes	No[1]
Alternative 8a – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements excluding RD 17	Yes	Yes	Yes	Yes
Alternative 8b – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements including RD 17	Yes	Yes	Yes	No[1]
Alternative 9a – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass excluding RD 17	Yes	Yes	Yes	Yes
Alternative 9b – North and Central Stockton – Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass including RD 17	Yes	Yes	Yes	No[1]

[1] See Section.3.6

3.6 EO 11988, FLOODPLAIN MANAGEMENT

3.6.1 EO 11988 ANALYSIS

ER 1165-2-26 provides the general guidance and policy for USACE's implementation of EO 11988 for all civil works projects. Paragraph 7 of the regulations states: "...It is the policy of the Corps of Engineers to formulate projects which, to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no practicable alternative. The decision on whether a practicable alternative exists will be based on weighing the advantages and disadvantages of floodplain sites and non-floodplain sites. Factors to be taken into consideration include, but are not limited to...the functional need for locating the development in the floodplain...The test of practicability will apply to both the proposed Corps action and to any induced development likely to be caused by the action."

Figure 3-14 outlines the analysis process as described in 43 FR 6030, U.S. Water Resources Council, Floodplain Management Guidelines for Implementing EO 11988, dated February 10, 1978.

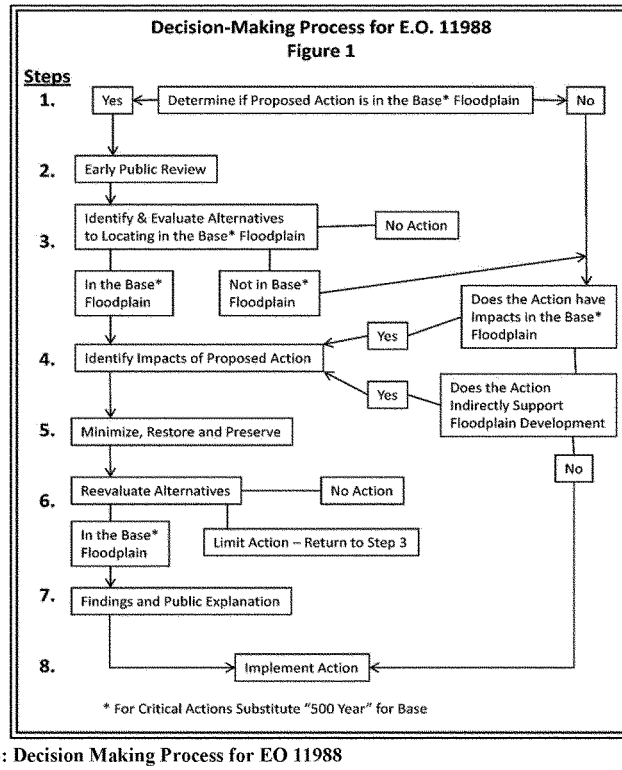


Figure 3-14: Decision Making Process for EO 11988

To comply with EO 11988 and ER 1165-2-26, projects are formulated and recommended that, to the extent possible, avoid, minimize and/or mitigate adverse effects associated with use of the floodplain and avoid inducing incompatible development unless there is no practicable alternative. Achieving flood and coastal storm risk management objectives generally cannot avoid locating actions in riverine or coastal floodplains. The requirements below are consistent with the EO 11988 decision process displayed in Figure 1 in Water Resources Council, Floodplain Management Guidelines for Implementing EO 11988, February 10, 1978 (43 FR 6030) (Figure 3-14).

1. Determine if the proposed action is in the base floodplain.

The overall purpose of the project is to reduce flood risk to urban and urbanizing parts of the study area. The final array of alternatives involve improving levees or constructing new levees located in the base 1% ACE floodplain. For the purpose of this study, the base floodplain is delineated as all areas that are at risk of being flooded by the 1% ACE flow; it has been delineated assuming existing levees do not provide protection from the 1% ACE event. This definition of the base floodplain addresses the USACE requirement in ER 1105-2-101 to describe a project's performance using risk and uncertainty methods and for purposes of studies ER 1105-2-101, does not require USACE to give deference to the current accreditation for RD 17's levee system provided by the FEMA in 2011. For this reason, the entire study area was evaluated for EO 11988 compliance.

2. If the action is in the base floodplain, identify and evaluate practicable measures to the action or to the location of the action in the base floodplain.

The study evaluated all practicable measures (40 FR 6030) by following the six-step planning process and evaluating a wide range of measures using available information, professional judgment and risk-informed decision making to achieve the project purpose. Practicable measures (structural and non-structural) considered are as follows:

North Stockton

- No Action: This would involve no Federal action within the base floodplain. No additional reductions in flood risk would be realized.
- Improvement of Paradise Cut: Screened out because the cost exceeded the benefits and it did not address geotechnical levee failure modes.
- Flood proofing and raising existing structures and infrastructure: Determined to not be cost effective.
- Reservoir reoperation: Screened out due to potential system-wide effects and because it did not address geotechnical failure modes.
- Reduce geotechnical failure probability and increase height of existing levees: These measures were retained. The geotechnical issues addressed are primarily through and under seepage with areas on the Delta Front requiring seismic stabilization.

Central Stockton

- No Action: This would involve no Federal action within the base floodplain. No additional reductions in flood risk would be realized.
- Improvement of Paradise Cut: Screened out because the cost exceeded the benefits and it did not address geotechnical levee failure modes.
- Flood proofing and raising existing structures and infrastructure: Determined to not be cost effective.
- Reservoir reoperation: Screened out due to potential system-wide effects and because it did not address geotechnical failure modes.
- Reduce geotechnical failure probability and increase height of existing levees: These measures were retained. The geotechnical issues addressed are primarily through and under seepage with areas on the Delta Front requiring seismic stabilization.

RD 17

- No Action: This would involve no Federal action within the base floodplain. No additional reductions in flood risk would be realized for 46,500 existing residents and two major highways, two major railroads and the Sharpe Army Depot.
- Improvement of Paradise Cut: Screened out because the cost exceeded the benefits and it did not address geotechnical levee failure modes.
- Flood proofing and raising existing structures and infrastructure: Determined to not be cost effective.
- Reservoir reoperation: Screened out due to potential system-wide effects and because it did not address geotechnical failure modes.
- Ring levees: Inclusion may be effective in some study areas, but will need to be incrementally cost effective to be practicable.
- Set-back levees: Determined to be cost effective for one reach in RD 17 with a length of approximately 3,500 feet.

Reduce geotechnical failure probability and increase height of existing levees: These measures were retained. The geotechnical issues addressed are primarily through and under seepage with areas on the Delta Front requiring seismic stabilization.

There are measures (40 FR 6030) that are outside USACE and the non-Federal sponsors' authority to implement, but may be considered by the local authorities:

- Institute a building moratorium within the study area; however, this does not address existing infrastructure.
- Implement building code requirements to elevate new construction above the 1% flood elevation; however, this measure does not address existing infrastructure.

Non-structural measures were not cost effective given that previous land use decisions were made based on FEMA accredited levees (Shaded Zone X) in all study areas. Currently, there is a section of Central Stockton that is designated as Zone A. The 2 square mile area is bounded by the Calaveras River to the north and Smith Canal to the south. The rest of the study area currently remains Shaded Zone X.

Detailed analyses were performed for the final array that found the structural improvements to be the only practicable and cost effective possibilities that achieve project objectives. Implementation of the proposed structural measures will reduce the flood risk to thousands of commercial, institutional and residential structures and transportation routes.

3. If the action must be in the floodplain, advise the general public in the affected area and obtain their views and comments.

Early public review has been conducted through public scoping via a published NOI to Prepare an EIS, a public scoping meeting, and public comments received on the Draft Report of the proposed study. Interested parties and resource agencies have been coordinated with during the course of the study. Additional opportunities for public input and comment will be provided during the review period for the Final Integrated Report.

4. Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial floodplain values. Where actions proposed to be located outside the base floodplain will affect the base floodplain, impacts resulting from these actions should also be identified.

a. Beneficial impacts due to the action.

The existing non-project and project levees along the Delta Front and Calaveras River provide FRM for approximately 131,000 people in the northern portion of the city of Stockton. The levees also provide FRM for critical infrastructure including schools, fire and police stations, a hospital and major transportation routes including Interstate 5 and Highway 99. Inclusion of Delta Front and Calaveras River Alternatives will provide improved FRM to this large population and the existing critical infrastructure.

The existing project levees along the San Joaquin River and Calaveras River provide FRM for approximately 128,000 people in the central portion of the city of Stockton. The levees also provide FRM for critical infrastructure including schools, fire and police stations, a hospital and major transportation routes including Interstate 5 and Highway 99. Inclusion of San Joaquin River and Calaveras River Alternatives will provide improved FRM to this large population and the existing critical infrastructure.

The existing RD 17 project levees provide FRM for approximately 46,500 people in portions of the cities of Stockton, Lathrop, Manteca and San Joaquin County. The project levees also provide FRM for critical infrastructure including schools, fire and police stations, the county jail, Sharpe Army Depot, a hospital and major transportation routes including Interstate 5 and Highway 120. Inclusion of RD 17 Alternatives will provide improved FRM to this large population and the existing critical infrastructure.

Currently, the levee safety program has defined the levee system that incorporates RD 17 as bounded on the north by Walker Slough, west by the San Joaquin River and south by the Stanislaus River. This includes RD 17, RD 2096, RD 2094, RD 2075 and RD 2064 (Figure 3-15). The alternatives that include RD 17 incorporate a tieback extension at the southern end of RD 17, thereby placing a limit on future growth to the south by not providing improvements below Manteca. Without the tie-back extension, levee improvements would have been necessary further upstream on the San Joaquin River and along the Stanislaus River to achieve the same flood risk reduction for the already urbanized portions of RD 17 and would have added about 16,000 acres of land that would be available for future development. These plans are currently under revision and it is likely that the acreage may be reduced. It is unlikely that such a project could be economically justified.

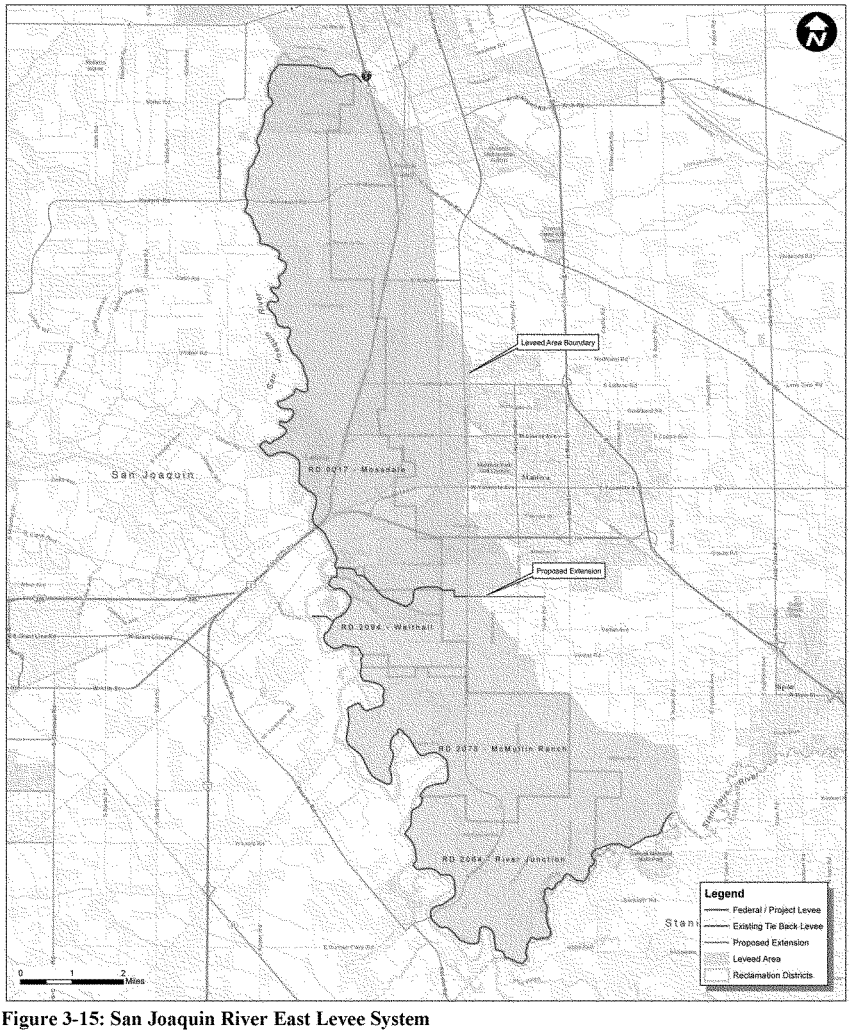


Figure 3-15: San Joaquin River East Levee System

b. Adverse impacts due to the action.

The final array of alternatives will facilitate further development in North and Central Stockton. Any future development, about 2,700 acres, will be infill of existing developed areas. The alternatives that include RD 17 would facilitate development of disturbed, but non-urbanized areas of Stockton, Lathrop, Manteca and unincorporated San Joaquin County. The Stockton, Manteca and Lathrop General Plans designated 5,300 acres for urbanization within RD 17. A majority of the acres would be new urbanization versus infill. In addition, 7,200 acres of disturbed but not yet urbanized land would be available for future development should local communities update their General Plans. These plans are currently under revision and it is likely that the acreage may be reduced. The City of Lathrop has recently eliminated 2,055 acres from its Sphere of Influence. Compliance with the Delta Plan will also reduce the potential for development. The RD 17 levee system is currently accredited by FEMA; therefore, the area currently has no Federal restriction associated with development. Implementation of proposed structural improvements will meet certain compliance requirements for SB 5. Additional improvements will likely be necessary by non-Federal agencies in order to fully comply with SB 5. The penalty for non-compliance is a moratorium on future development until the appropriate level of FRM is attained. Alternatives including RD 17 would facilitate development by providing a higher degree of FRM. Figure 3-17 shows the planned development areas within RD 17 and inundation depths for the base flood (1% (1/100) ACE event). The 1% ACE, sometimes referred to as a "100-year" event, is equivalent to a flood event with a 1% chance of occurring in any given year. Full development of the infill would result in a population increase of approximately 20,000 people. The current emergency evacuation plan identifies seven evacuation routes from the North and Central Stockton which is deemed adequate for current population. Since buildout of the infill is anticipated to be gradual over the project life, no adverse effect to the evacuation plan is expected. The City of Stockton updates their emergency response plans as needed and would accommodate population growth as part of such update.

c. Expected losses of natural and beneficial floodplain values.

The natural floodplain has been greatly reduced within the study area by the manner in which the existing levee system was constructed in the early 20th Century. The system was constructed with the levees in close proximity to the active river channel to maximize development of arable land for agriculture, followed by urban growth of the Stockton, Lathrop and Manteca communities into unincorporated areas of San Joaquin County. The Flood Control Act of 1944 provided USACE authorization to further improve the levee system. The Standard O&M Manual for the LSJR Levees, Lower San Joaquin River and Tributaries Project, California, describes the protection provided by the project as follows:

"The Lower San Joaquin and Tributaries Project will provide protection from all floods of record to about 120,000 acres of fertile agricultural lands; to a suburban area south of the city of Stockton and about four small communities; to other areas developed for residential and industrial purposes; to two transcontinental highways and other State and County highways from all floods of record. The project made possible the reclamation of areas that can be developed to a higher degree when protection against flood hazard is assured."

The natural floodplain was separated from the river channels by the levee system so that the functionality and natural values are severely constrained. Due to the urbanization, there are few opportunities for restoration of the natural floodplain in the study area. As described in Paragraph 5 below, there are 3,250 acres of planned development with infrastructure improvements in place in the Lathrop portion of RD 17. The natural floodplain is not reduced within the study area by the proposed action.

Current placement of the levees and activities related to the improvements to those levees reduce the beneficial values of water resources (natural moderation of floods, water quality maintenance and ground water recharge); living resource values (fish, wildlife and plant resources) and cultural resource values

(open space, natural beauty, scientific study, outdoor education and recreation). There are some benefits to cultivated resource values (agriculture, aquaculture and forestry) as a result of implementation of proposed improvements.

A large setback levee was evaluated for a reach of the main stem San Joaquin River adjacent to RD 17, but was not found to be economically justified. This alternative was not evaluated for ecosystem benefits as the study focused on single-purpose FRM plan formulation. Further, degradation of the existing levee may have adverse effects on the flow splits at Paradise Cut and Old River. The alternative was formulated to retain the existing FRM benefits to the area within the setback while retaining the existing flow splits at Old and Middle Rivers.

5. If the action is likely to induce development in the base floodplain, determine if a practicable non-floodplain alternative for the development exists.

The areas of North and Central Stockton that would see improved FRM from the proposed alternatives are predominantly already developed. As shown in Figure 3-17, most potential future development within the floodplain would be infill of previously developed areas. This in-fill development is relatively modest in size and within the current city limits. The current General Plan for the City of Stockton accounts for this potential infill development in its coverage of emergency services and floodplain management plan.

In RD 17, agriculture was followed by the urban growth of the Stockton, Lathrop and Manteca communities into unincorporated areas of San Joaquin County. Due to the urbanization, there is a sizable population within the RD 17 basin. While the city limits of Stockton and Manteca have areas not yet urbanized that are outside the floodplain, the city of Lathrop is entirely within the 200-year floodplain. Due to this, there are no practicable alternatives to development within the floodplain. Within the city of Lathrop, 3,200 acres of infrastructure (utilities, roads, etc.) were placed in anticipation of additional development. The following describes major investments that have already occurred that would make it difficult to relocate some of the planned development.

West Lathrop Specific Plan Area: This includes vacant areas in the Mossdale Village portion of the West Lathrop Specific Plan Area and includes 230 acres of undeveloped land owned by Silviera, plus 131 acres under various ownerships. Full infrastructure was constructed to bring the transportation network and utilities (water, sewer, storm drainage, and flood control) to these properties and most properties pay special tax assessments for these improvements. Most of Mossdale has been constructed, and the over-sizing of these improvements anticipates and requires, that the remaining area within Mossdale be developed to pay back these costs. Tens of millions were spent on this infrastructure.

Central Lathrop Specific Plan (CLSP) Area: This includes 1520 master planned acres that were annexed. Improvements include sewer and storm drain collection systems. $200 million in assessments were approved and $50 million were sold; another $50 million in developer equity to construct infrastructure.

Gateway Specific Plan Area: This includes 384 acres of industrial and commercially zoned property in an approved Specific Plan and EIR. Many acres were annexed and are under active development planning. Millions were and tens of millions are about to be spent on infrastructure.

East (historic) Lathrop: This includes two underdeveloped areas, including 168 acres on McKinley near Shideler Parkway and 253 acres in the Louise/Park Avenue area. This was a portion of the original city of Lathrop boundaries and has full utilities and arterial roadways adjacent. It is under active development planning. Tens of millions were spent on infrastructure.

Roth Road Area: This area of 250 acres is adjacent to the northern border of Lathrop and fronts a major arterial with existing water mains for build-out, paid for by assessments on the undeveloped parcels. All utilities have been master planned and detailed plans for storm drainage and sewer service are under review to allow for build-out. Millions were spent on infrastructure and tens of millions are about to be spent to allow development.

South Lathrop Specific Plan Area: This 315 acre industrial and commercial area within the 1989 General Plan boundaries has a Specific Plan, Development Agreement and EIR coming to the City Council for approval in the near future. Millions were spent on these entitlements.

The Oakwood Shores development, located within the deepest area of flooding in Manteca, has roads and utilities and many of the lots already contain houses. As Figure 3-17 shows, the proposed urbanization within RD 17 occurs in the deepest areas of inundation. While some of the planned development could be relocated from the deepest areas of inundation, it may not be practicable to fully relocate all future development outside the floodplain.

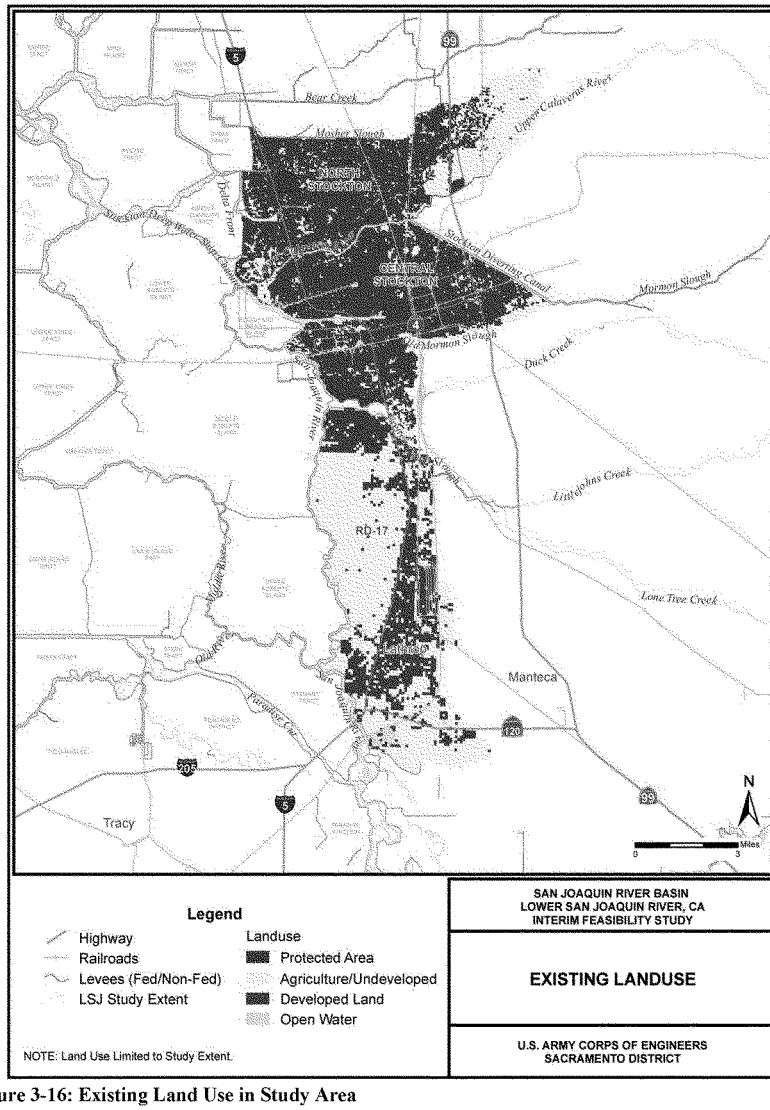


Figure 3-16: Existing Land Use in Study Area

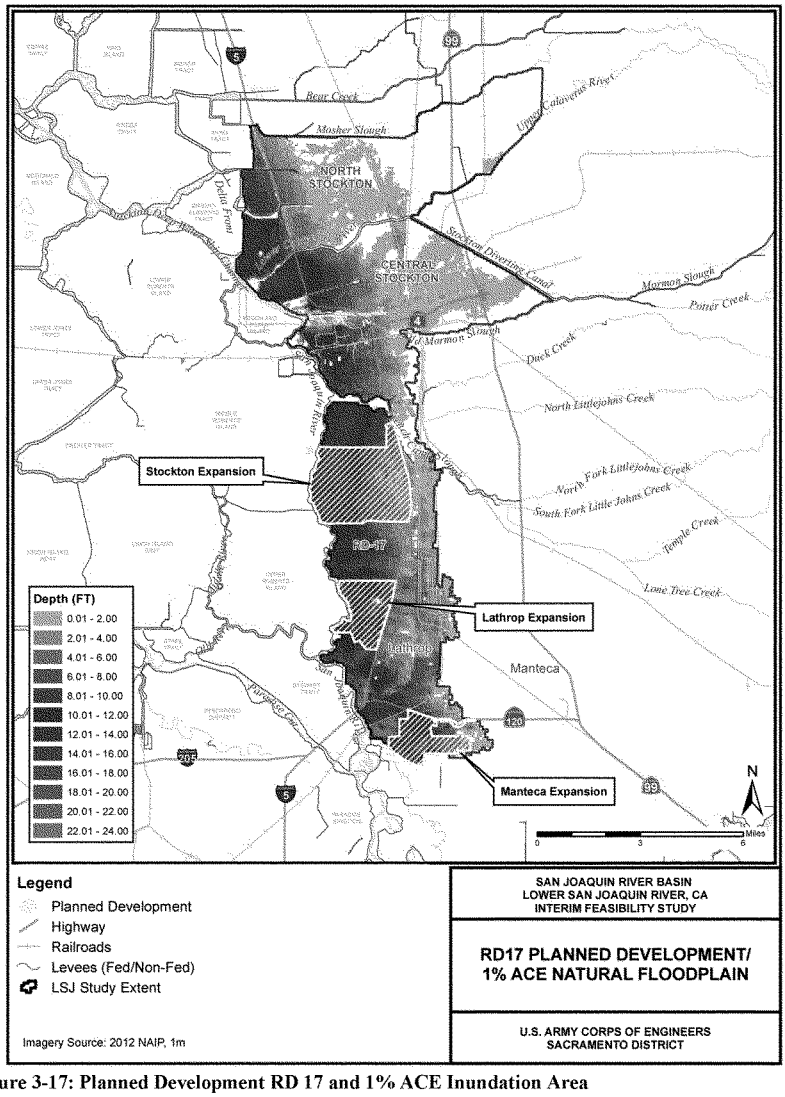


Figure 3-17: Planned Development RD 17 and 1% ACE Inundation Area

6. As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impact of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial floodplain values. This should include reevaluation of the "no action" alternative.

The historic placement of levees in the study area precludes opportunities for restoration or enhancement of natural floodplain values. Setback levees were analyzed for RD 17 but were not economically justified. For North Stockton, placement of the Delta Front levee along Fourteenmile Slough will allow some opportunity for restoration efforts.

Based on existing land use planning for further development in RD 17 in the deepest parts of the floodplain (highest life safety consequence), the decision was made to remove the RD 17 alternatives from further consideration (Alternatives 7b, 8b and 9b). The Principles and Guidelines state that Federal investments in water resources should avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used. While few practicable alternatives to development in the floodplain were identified, it was determined that the proposed development, as shown in the General Plans, is unwise from the perspective of supporting Federal investment for a FRM project under current land use plans.

7. If the final determination is made that no practicable alternative exists to locating the action in the floodplain, advise the general public in the affected area of the findings.

The public had an opportunity to comment on this analysis and determination when the Draft FR/EIS/EIR was released for concurrent public, resource agency, independent external peer and USACE technical, policy and legal reviews.

8. Recommend the plan most responsive to planning objectives established by the study and consistent with the requirements of the EO.

Existing infrastructure, such as transportation routes, housing, agricultural improvements, levees and drains, limits the potential for restoration of the San Joaquin River natural hydrology and ecosystem functions.

The RD 17 alternatives are removed from consideration based on the Principles and Guidelines, which state that Federal investments in water resources should avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used. The proposed placement of development within the RD 17 basin is in the deepest part of the floodplain (highest life safety consequence). The remaining alternatives (Alternatives 7a, 8a and 9a) have little or no unmitigated adverse effects due to the fully developed nature of the North and Central Stockton areas.

Critical Actions. Repeat steps 1 through 8 above for critical actions in the floodplain for the full range of potential residual flood risks. The critical action floodplain is defined as the 500-year floodplain (0.2 percent chance floodplain).

1. Determine if the proposed action is in the critical action floodplain.

Proposed actions being analyzed by this study are within the critical action floodplain.

2. If the action is in the critical action floodplain, identify and evaluate practicable alternatives to the action or to the location of the action in the base floodplain.

There are no practicable alternatives to the proposed actions being situated within the critical action floodplain. See Base Floodplain Step 2.

3. If the action must be in the critical action floodplain, advise the general public in the affected area and obtain their views and comments.

See Base Floodplain Step 3.

4. Identify beneficial and adverse impacts due to the action and any expected losses of natural and beneficial floodplain values. Where actions proposed to be located outside the 0.2% floodplain will affect the 0.2% floodplain, impacts resulting from these actions should also be identified.

The critical infrastructure currently located in the critical action floodplain includes 2 major interstate and international highways (I-5, CSR-99), 4 hospitals, 9 fire stations, 8 police stations, 3 railroads, a wastewater treatment plant and an airport and currently consists of the developed portions of the Cities of Stockton, Lathrop and Manteca. There are no liquefied natural gas terminals and facilities producing and/or storing highly volatile, toxic or water-reactive materials in the study area. Current population at risk is approximately 235,000 within the 0.2% ACE natural floodplain and possible damageable property amounts to $28.7 billion. If flooded, an added dimension to the disaster would be a possible wastewater treatment plant containment failure, which would impact water quality in the Delta and could interrupt water deliveries to communities in the southern valley and to Southern California.

Beneficial impacts due to the action would include risk management to the current critical infrastructure within the study area. Adverse impacts include the possibility for additional critical infrastructure being located within the RD 17 basin, potentially in the deepest areas of flooding, thereby increasing the amount of the critical infrastructure already in place.

See Base Floodplain Step 4 above for the expected losses of natural and beneficial floodplain values discussion.

5. If the action is likely to induce development in the critical action floodplain, determine if a practicable non-floodplain alternative for the development exists.

There may be opportunities to locate future critical facilities outside the critical action floodplain. However, facilities such as schools and fire stations must be within close proximity to any future development. Therefore, if development occurs as shown in Figure 3-17, there will be no practicable alternative for these critical facilities.

6. As part of the planning process under the Principles and Guidelines, determine viable methods to minimize any adverse impact of the action including any likely induced development for which there is no practicable alternative and methods to restore and preserve the natural and beneficial floodplain values. This should include reevaluation of the "no action" alternative.

See Base Floodplain Step 6.

7. If the final determination is made that no practicable alternative exists to locating the action in the floodplain, advise the general public in the affected area of the findings.

See Base Floodplain Step 7.

8. Recommend the plan most responsive to the planning objectives established by the study and consistent with the requirements of the EO.

As a result of the analysis required for compliance with EO 11988, USACE determined that alternatives 7a, 8a and 9a have little or no unmitigated adverse effects to floodplain areas and are therefore compliant with EO 11988.

3.6.2 RESULT OF EO 11988 ANALYSIS

As a result of the analysis required for compliance with EO 11988, RD 17 alternatives 7b, 8b and 9b were removed from further consideration. It is understood that RD 17, with funding assistance from the State, is pursuing a phased strategy of levee improvements to increase the resistance of RD 17's levee system to under and through seepage to address residual flood risk. Upon completion of that work, RD 17 intends to request USACE participation in additional improvements to achieve 0.5 percent ACE FRM in order to meet SB 5 requirements. Consideration of future Federal participation would be subject to demonstration of a Federal interest in such improvements.

3.7 ENVIRONMENTAL CONSIDERATIONS AND MITIGATION

NEPA and CEQA require that the environmental effects of a project be analyzed. Chapter 5 describes the environmental impacts of the study alternatives, and of measures that would mitigate impacts. Most impacts could be mitigated to less than significant, but certain resources would experience significant unavoidable impacts, even with mitigation.

3.7.1 REGIONAL CONTEXT

Riparian habitats are substantially reduced from their historical extents throughout the Central Valley. Only about 2 to 5 percent of the historic riparian habitat still exists (RHJV 2004). Establishment of the FRM system, with levees set immediately adjacent to the main rivers and tributaries, contributed to this decline and continues to result in conflicts between ecosystem health and sustainability and maintenance of the FRM system. Upstream of the proposed project area, considerable Federal and State investment was made to improve the riparian corridor as part of the San Joaquin River Restoration Program and the Federal and State refuge systems.

Riparian vegetation provides important ecological functions, including: wildlife habitat; migratory corridors for wildlife; pollution filtration and waterway shading, thereby improving water quality; provides connectivity between waterways and nearby uplands; and biomass (nutrients, insects, large woody debris, etc.) to adjacent waterways. Riparian forests and woodlands – even remnant patches – are important to resident and migratory fish, birds and other wildlife.

3.7.2 STUDY AREA

Throughout most of the study area, vegetation is highly altered and fragmented. Nevertheless, this vegetation is all that remains as habitat to resident and migratory fish and wildlife in the area. Oak woodland, riparian forest, riparian scrub-shrub, wetlands, annual grassland and Shaded Riverine Aquatic (SRA) habitat are present within the footprint of all of the alternatives.

3.7.3 IMPACT ANALYSIS AND COMPENSATORY MITIGATION

Each action alternative evaluated (Alternatives 7a, 7b, 8a, 8b, 9a and 9b) would remove nearly all existing waterside SRA and woody riparian vegetation in the reaches where levee improvements are proposed. Opportunities to provide compensatory mitigation onsite are severely limited because of the proximity of the existing levees to the rivers and tributaries and by the feasibility phase assumption that the project will include the Vegetation Free Zone (VFZ) required by USACE ETL 1110-2-583. If the project is authorized and funded, the suitability of all or a portion of the project for a variance to the VFZ requirement would be evaluated during PED. This assumption also influences the magnitude of the impact on vegetation.

Compensatory mitigation would be accomplished through a combination of mitigation bank credits and offsite mitigation plantings. Mitigation costs are appropriately recognized within the parametric cost

estimate. Table 3-8 summarizes waterside SRA and woody riparian vegetation that would be removed as a result of implementing each action alternative. Landside vegetation would be similarly affected.

Table 3-8: LSJRFS Waterside Vegetation[1] Directly Impacted by Implementation of Each Action Alternative

	Alternative		
	7a	**8a**	**9a**
NORTH STOCKTON			
SRA (linear feet)	9,054	9,054	9,054
Woody Riparian (acres)	7	7	7
CENTRAL STOCKTON			
SRA (linear feet)	25,508	25,674	25,508
Woody Riparian (acres)	27	27	27
RD 17			
SRA (linear feet)	0	0	0
Woody Riparian (acres)	0	0	0
TOTAL			
SRA (linear feet)	34,562	34,728	34,562
Woody Riparian (acres)	34	34	34

[1]"Waterside" refers to the side of the levee nearest the proximate body of water (e.g. not the distant Delta). "Waterside Vegetation" refers to vegetation on the waterside levee slope and within 15 feet of the waterside levee toe.

3.8 IDENTIFICATION OF THE NED PLAN

The following paragraphs and tables show the analysis of the policy compliant plans to identify the NED plan.

Table 3-9 displays the economic summary analysis of the costs and benefits for the comparison of alternatives. Of note in the analysis is that the preliminary net benefits for the alternatives ranged from $283 to $294 million, within the error bounds of the analysis. The residual equivalent annual damages (EAD) a represent the damageable property remaining for all events for each alternative.

Table 3-9: Economic Summary for Final Alternatives

Alternative	Investment Cost ($1,000s)[1]	Residual EAD ($1,000s)	Annual Benefits ($1,000s)[2]	Annual Cost ($1,000s)	Net Benefits ($1,000s)[2]	BCR
No Action – Alternative 1	-	362,000	-	-	-	-
Alternative 7a	1,005,000	65,000	322,000	39,000	283,000	8.26
Alternative 8a	1,143,000	48,000	340,000	46,000	294,000	7.39
Alternative 9a	1,015,000	57,000	330,000	41,000	289,000	8.05

[1]Includes interest during construction.
[2]Includes benefits during construction.

Residual annual damages are the remaining annualized damages in the study's economic impact areas after completion of the alternative. Because RD 17 was excluded from the final alternatives, there is no reduction of damages for that area. The alternatives reduce EAD within the study area by approximately 85% from the FWOP condition. Table 3-10 summarizes the information.

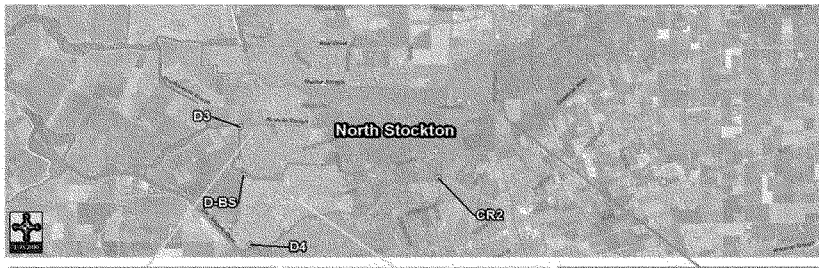
Table 3-10: Residual Damages

Alternative	Residual Annual Damages ($1,000s)				EAD Reduction ($1,000s)	% EAD Reduction in Study Area
	North Stockton	Central Stockton	RD 17	Total		
No Action – Alternative 1	244,000	92,000	26,000	362,000	0	-
Alternative 7a	12,000	25,000	26,000	63,000	299,000	82.6%
Alternative 8a	2,000	20,000	26,000	48,000	314,000	86.7%
Alternative 9a	8,000	23,000	26,000	57,000	305,000	84.3%

The results of comparing the plans in Table 3-9 showed that the net benefits of the alternatives are statistically equal given the methodology used in the analysis. Figures 3-18 and 3-19 show a more detailed breakdown of where the reduction in EAD may be realized for North and Central Stockton, respectively.

Alternative 7a had the highest net benefit of the final alternatives, being approximately $283 million with a BCR of 8.26 to 1. In accordance with ER 1105-2-100 Appendix G, Amendment #1 Exhibit G-1, "Where two cost effective plans produce no significantly different levels of net benefits, the less costly plan is to be the NED plan, even though the level of outputs may be less." As such, Alternative 7a is identified as the NED Plan.

The identification of Alternative 7a as the NED Plan serves to set the level of Federal participation in the project. Alternative 7a may not fully meet the NFS objective of SB 5 compliance, but in order to expedite authorization, the NFS elected not to pursue a Locally Preferred Plan (LPP) at this time.



NORTH STOCKTON 02			
Population 26,000			
Maximum Depth of Flooding: 12 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	D3	112,000	15.19%
LS-7a	D3	2,000	0.03%
LS-8a	D3	2,000	0.03%
LS-9a	D3	2,000	0.03%

NORTH STOCKTON 03			
Population 22,000			
Maximum Depth of Flooding: 18 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	D-BS	67,000	15.21%
LS-7a	CR2	2,000	0.94%
LS-8a	D4	240	0.01%
LS-9a	CR2	1,000	0.51%

NORTH STOCKTON 04			
Population 83,000			
Maximum Depth of Flooding: 6 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	CR2	2,000	0.94%
LS-7a	CR2	2,000	0.94%
LS-8a	CR2	100	0.01%
LS-9a	CR2	1,000	0.51%

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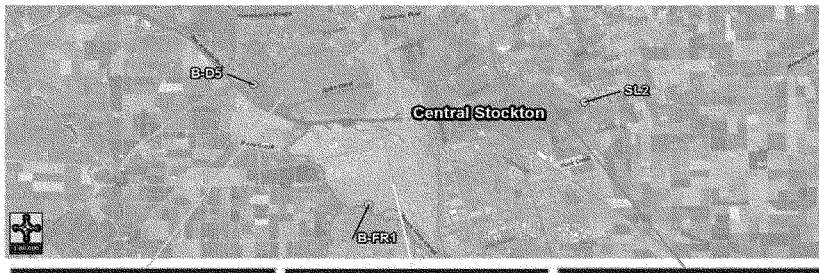
RESIDUAL RISK BY IMPACT AREA
NORTH STOCKTON

Figure 3-18: North Stockton Residual Risk



CENTRAL STOCKTON 01			
Population 25,000			
Maximum Depth of Flooding: 17 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	D5	77,000	11.97%
LS-7a	FR1	7,000	0.73%
LS-8a	FR1	7,000	0.73%
LS-9a	FR1	7,000	0.73%

CENTRAL STOCKTON 02			
Population 53,000			
Maximum Depth of Flooding: 13 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	FR1	29,000	2.70%
LS-7a	FR1	12,000	0.73%
LS-8a	FR1	12,000	0.73%
LS-9a	FR1	12,000	0.73%

CENTRAL STOCKTON 03			
Population 50,000			
Maximum Depth of Flooding: 6 ft			
Plan	Highest Risk Index Point	EAD ($1,000s)	AEP
No Action	SL2	1,600	1.53%
LS-7a	SL2	1,600	1.53%
LS-8a	SL2	14	0.01%
LS-9a	SL2	900	1.09%

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RESIDUAL RISK BY IMPACT AREA
CENTRAL STOCKTON

Figure 3-19: Central Stockton Residual Risk

3.9 SELECTING A RECOMMENDED PLAN

The system of accounts established by the Principles and Guidelines were used to evaluate the final array of alternatives. In Table 3-11, 1 represents minimum increase, 2 represents moderate increase and 3 represents large increase. The ratings represent the comparison of the alternatives to each other, not to the No Action alternative. The NED and life safety metrics are comparable to each other among Alternative 7a, Alternative 8a and Alternative 9a. An evaluation of flood-depth, human mobility and flood wave travel time did not indicate a high life safety risk differential between the action alternatives.

All the alternatives reasonably maximize net benefits. The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects have used nationally consistent projections of income, employment, output and population. The EQ metric used was potential effect on the environment. The OSE metrics were population remaining at risk and available evacuation routes for the alternatives. The higher OSE rating for 8a results from reduction of residual floodplains for North and Central Stockton, improving safety and access to evacuation routes. While these ratings are subjective, it is evident that Alternative 8a reasonably maximizes project outputs across all four accounts.

Table 3-11: Comparison of Alternatives to Principles and Guidelines System of Accounts

Alternative	NED	RED	EQ	OSE
No Action – Alternative 1	1	1	1	1
Alternative 7a	3	3	1	2
Alternative 8a	3	3	1	3
Alternative 9a	3	3	1	2

Note: 1 represents minimum increase, 2 represents moderate increase and 3 represents large increase.

Table 3-12 summarizes information for the alternatives to demonstrate economic benefits and life-safety parameters that show differences between the alternatives. Project performance is represented by Annual Exceedance Probability (AEP) represented as a percentage. For example, a 1 percent AEP is equivalent to the area being flooded once every 100 years on average. The AEPs for the separable areas differ by alternative due to the amount the alternative reduces the probability of flooding. The AEPs range from 0.2 percent to 2.6 percent. For the population remaining at risk, the 1 percent AEP event is used to analyze evacuation routes and residual floodplains metrics.

Table 3-12: Comparison of Alternatives

Analysis Metric	Area	No Action	Alt 7a	Alt 8a	Alt 9a
Project performance by Impact Area (AEP)[1]	**North Stockton**	21%	1%	0.2%	0.5%
	Central Stockton	16%	1.7%	0.8%	1.5%
	RD 17	2.6%	2.6%	2.6%	2.6%
Developable Area (acres)		15,541	15,541	15,541	15,541
Population with <90% assurance for the 1% ACE event	**North Stockton**	83,000	83,000	0	83,000
	Central Stockton	79,000	79,000	0	79,000
	RD 17	43,600	43,600	43,600	43,600
Critical Infrastructure with <90% assurance for the 1% ACE event[2,4]		23	23	11	23
Critical Infrastructure of Regional Economic Significance with <90% assurance for the 1% ACE event[3,4]		463	452	171	404
Evacuation Routes with >90% assurance for the 1% ACE event	**North Stockton (11)**	0	9	11	9
	Central Stockton (32)	0	25	32	25
	RD 17 (7)	0	0	0	0

[1] AEP – Annual Exceedance Probability as expressed in percentage.
[2] Critical Infrastructure – Life Safety: Fire/Fire EMS, Police, Hospitals, Jails, Airports, WTP, WWTP.
[3] Critical Infrastructure – Regional Economic Significance: Substations, Schools, Power Plants, Chemical Industry, Colleges, Intermodal Shipping, Heliports, Petroleum Bulk Plants, Broadcast Communication.
[4] Structural inventory based on the 500-year floodplain: changes in affected floodplains seen at the 1% ACE event.

Based on the information presented in Sections 3.6, 3.8 and 3.9 above, Alternative 7a is identified as the NED plan and selected as the RP.

3.10 THE RECOMMENDED PLAN

The RP is Alternative 7a, North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River Levee Improvements excluding RD 17 (Figure 3-8). This plan meets the study objectives of reducing flood risk and flood damages, reducing flood risk to public health, safety and life, minimizes residual flood risks to the extent justified, and incorporates environmentally sustainable design principles.

Alternative 7a is the Preferred Alternative and the Environmentally Preferable Alternative under NEPA. It is also the Least Environmentally Damaging Practicable Alternative under the Clean Water Act (CWA). The structural features of Alternative 7a include 23 miles of levee improvements and two closure structures, one at Fourteenmile Slough and the other at Smith Canal. The levee improvements include a cutoff wall, deep soil mixing (seismic), a new levee, levee geometry improvements and erosion protection.

Recommendations for addressing residual risk to be performed by the non-Federal sponsor include non-structural features, such as Comprehensive Flood Warning Emergency Evacuation Planning and Floodplain Management. Specifics of such plans will be included in the language of the Project Partnership Agreement signed after project authorization.

Chapter 8 contains a description of the RP, and Section 8.1.5 shows tables with a first cost breakout for the RP as well as estimated annual costs. These costs may change during additional analysis.

Alternative 7a, if authorized, would be subject to cost sharing for FRM projects at a 65 percent Federal and 35 percent non-Federal ratio. The NFS are responsible for all LERRDs costs, a minimum of 5 percent cash and any additional cash needed to reach a minimum of 35 percent of the total project cost. The maximum non-Federal share is 50 percent of the total project cost. Table 8-7 shows the preliminary cost allocation for Alternative 7a.

CHAPTER 4 — DESCRIPTION OF FINAL ALTERNATIVES

4.1 INTRODUCTION

This chapter provides additional details to the final array of alternatives identified in Chapter 3. NEPA requires a greater level of detail in order to analyze potential effects of the proposed alternatives on the natural and human environment. Under NEPA, both the proposed project and project alternatives are each analyzed at the same level. CEQA project alternatives are usually analyzed at a lesser degree than the proposed project and the primary comparison is as an alternative to the proposed project. The common objective of both CEQA and NEPA is to identify the potential impacts on the human environment if the preferred alternative is approved and consider alternatives that could also address the purpose and objectives of the project.

NEPA and CEQA take a slightly different approach to considering project alternatives. However, both sets of environmental laws have the objective to inform decision makers and the public of the environmental effects of a project and ways those effects could be mitigated through measures to avoid, minimize, rectify, reduce or compensate for adverse impacts.

4.1.1 DETERMINATIONS SINCE THE DRAFT REPORT WAS PUBLISHED

Since the Draft Report was released in February 2015, Alternative 7a has been identified as the:

- Recommended Plan (RP)
- NEPA Preferred Alternative
- NEPA Environmentally Preferable Alternative
- Clean Water Act Least Environmentally Damaging Practicable Alternative

4.1.2 CHANGES SINCE THE DRAFT REPORT WAS PUBLISHED

Since the Draft Report release in February 2015, some measures were refined and additional information incorporated. Alternative 7a, the RP, was refined to reduce or adjust the proposed footprint. The study approach to vegetation was clarified and an initial engineering review was completed to consider the likely suitability of levees for a variance to the vegetation USACE ETL 1110-2-583. Additional information and analysis was completed for the potential impacts of the RP on Federally listed species, designated critical habitat and essential fish habitat. In addition, refinements and clarifications were incorporated to address public and agency comments. In some cases, information was reorganized or consolidated to increase clarity and readability. These changes were made to augment, clarify or otherwise improve the information presented in the EIR. These changes do not result in significant new information, as defined by the CEQA Guidelines Section 15088.5 and as such do not result in requiring recirculation of the EIR prior to certification.

4.2 ALTERNATIVES CONSIDERED IN DETAIL

The Feasibility Study screened the alternative plans down to the final array of alternatives (with options). The difference between the two options for the action alternatives is that option "a" excludes levee work in RD 17, while option "b" includes it. As noted in Chapter 3, the "b" plans were eliminated from consideration due to non-compliance with EO 11988. For the purposes of NEPA and CEQA, those alternatives were retained and are included in this analysis.

- Alternative 1, No Action
- Alternative 7a, North and Central Stockton, Delta Front and Lower Calaveras River and San Joaquin River Levee Improvements (Chapter 3, Figure 3-8)
- Alternative 7b, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and RD 17 Levee Improvements (Chapter 3, Figure 3-9)
- Alternative 8a, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements (Chapter 3, Figure 3-10)
- Alternative 8b, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River and Stockton Diverting Canal Levee Improvements and RD 17 Levee Improvements (Chapter 3, Figure 3-11)
- Alternative 9a, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass (Chapter 3, Figure 3-12)
- Alternative 9b, North and Central Stockton, Delta Front, Lower Calaveras River, San Joaquin River Levee Improvements and Mormon Channel Bypass and RD 17 Levee Improvements (Chapter 3, Figure 3-13)

4.3 FINAL PROPOSED STRUCTURAL MEASURES

Alternatives are composed of different structural and non-structural measures or building blocks. Some structural measures are included in all alternatives but may vary in amount and/or location. Other structural measures are included in only some alternatives. Table 4-1 shows how the structural measures are applied to each of the action alternatives.

Table 4-1: Structural Measures Included in Each Action Alternative

	Alternatives					
Structural Measure[1]	**7a**	**7b**	**8a**	**8b**	**9a**	**9b**
Cutoff walls (mi)	20.1	34.2	30.6	44.7	20.1	34.2
Levee Reshaping (mi)	6	21	7	21.7	6	21
Seepage Berm (mi)	0	3.8	0	3.8	0	3.8
Floodwall (mi)	0.2	0.2	0.2	0.2	0.2	0.2
New Levee (mi)	0.75	2.2	0.75	2.2	0.75	2.2
Erosion Protection (most is landside) (mi)	5	9.7	5	9.7	5	9.7
Seismic Remediation (mi)	1.1	1.1	1.1	1.1	1.1	1.1
Setback levee (mi)	1.33	1.33	1.33	1.33	1.33	1.33
Closure Structure- Smith Canal (#)	1	1	1	1	1	1
Closure Structure Fourteenmile Slough (#)	1	1	1	1	1	1
Control Structure (Stockton Diverting Canal at Old Mormon Slough) (#)	0	0	0	0	1	1
Channel Improvements (Mormon Channel flood bypass) (mi)	0	0	0	0	6.3	6.3
New Bridges (#)	0	0	0	0	3	3

[1] Note that all alternatives include jet grouting for some utility and difficult infrastructure crossings.

4.3.1 CUTOFF WALLS

The predominant measure to improve levee performance is a slurry cutoff wall for the length of the project, except for portions of the levees requiring a seismic fix in North Stockton. See Figure 4-1 for a typical cutoff wall plan.

Description

Seepage cutoff walls are vertical walls of low hydraulic conductivity material constructed through the embankment and foundation to cut off potential through and under seepage. In order to be effective in reducing under-seepage, cutoff walls usually tie into an impervious sub-layer and would be constructed through the levee crown. Cutoff wall depths range from approximately 20 to 70 feet.

Construction Methods

A cutoff wall would be installed by one of two methods: (1) conventional open trench cutoff wall or (2) Deep Soil Mixing (DSM) cutoff wall. The method selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of 80 feet. The DSM method would be utilized for cutoff walls of greater depth.

Preparation

Prior to cutoff wall construction, the site and any staging areas would be cleared, grubbed and stripped. The levee is typically degraded by one-half its height to provide a sufficient working surface (approximately 30 feet) and reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids.

Construction

Conventional Method. The conventional slurry method for cutoff walls is an open trench that uses an excavator with a long-stick boom to dig the slurry trench. The cutoff walls for the project would be a minimum of 3-feet in width and constructed from a working surface elevation to a design depth at least 3-feet into an impermeable layer. The conventional method has a maximum depth of 70 to 80 feet.

During construction, bentonite-water slurry is used to keep the trench open and stable prior to backfilling with the permanent wall material. Soil is mixed with bentonite to form soil-bentonite and then pushed into the trench, displacing the bentonite-water slurry. After a predetermined settlement period, an impervious cap is constructed above the cutoff wall and the levee is reconstructed using suitable material (Type 1 levee fill) to the correct design elevation and current USACE levee design criteria.

DSM Method. Cutoff walls in North and Central Stockton could extend deeper than 70 feet below the surface elevation. The DSM method would require large quantities of cement bentonite grout, necessitating the use of a contractor-provided, onsite batch plant and deliveries of concrete aggregate, concrete sand, bentonite and cement. The batch plant would be powered by generators or electricity from power lines and would be located within the project area or an adjacent staging area. The batch plant area would consist of an aggregate storage system, aggregate rescreen system (if needed), rewashing facility (if needed), the batching system, cement storage, ice manufacturing and the grout mixing and loading system. All aggregate used would be obtained from local, commercial offsite sources.

From the batch plant, the grout mixture would be transported through high-pressure hoses (8,000 pounds per square inch [psi]) to the location of construction. A crane supported set of 2 to 4 mixing augers would be used to drill through the levee crown and subsurface to a maximum depth of 140 feet. As augers are inserted and withdrawn, cement bentonite grout would be injected through the augers and mixed with native soils. An overlapping series of mixed columns would be drilled to create a continuous seepage cutoff barrier. Once the slurry hardened, it would be capped and the levee embankment reconstructed with impervious or semi-impervious soil.

Excavated and Borrow Material Staging. Excavated and borrow material would be stockpiled at staging areas. Haul trucks, front end loaders and scrapers would bring materials to the site to be spread evenly and compacted according to levee design plans. The levee would be hydro-seeded once construction was completed.

Equipment

Equipment used in construction includes a water/bentonite slurry mixing facility, a backhoe or long reach trench excavator, a bulldozer for moving soil and mixing slurry material and a water line to produce the slurry product. The water/bentonite slurry is mixed onsite with soil as the final product used during the trench excavation.

Risk Management

Trench Management. For conventional cutoff walls (up to 80 feet below working surface), the integrity of the open trench is maintained through specifications for density of the trench bentonite slurry mixture. There are quality assurance/quality control testing requirements throughout construction that monitor mixture density to assure an open trench is maintained; walls exceeding 80 feet in depth would not involve an open trench.

Containment of Trench Slurry - Possibility of Fracture. To address containment of a trench slurry, the possibility of a fracture is reduced by degrading the levee to half of its original height to achieve a larger prism; this creates a wider working surface and placement of barriers to capture any surface materials. If a fracture were to occur, work would immediately stop and Federal, local and environmental agencies would be contacted to determine the extent and degree of remediation needed. The possible occurrence of such an event would be detailed in the Environmental Protection section of the contract specifications (not developed for feasibility study).

Containment of Trench Slurry - Displacement During Construction. Bentonite has a minimum hydration period and is stored in large Baker tanks until needed. Once construction begins, it is mixed in a container or small pond and pumped to the trench as it is excavated. When trench slurry levels drop, more slurry is added. As wall product is mixed and placed in the trench, fluid is displaced; however, if excavation and production occur in tandem, the level of trench slurry remains within a few feet of the top of trench throughout the day with minimum top off occurring. As the wall closes in towards its final stationing, trench slurry levels are no longer balanced by excavation and fill; the excess slurry will be pumped off the trench and disposed of offsite.

4.3.2 LEVEE SLOPE RESHAPING (ALSO CALLED "GEOMETRIC FIX") DESCRIPTION

Levee reshaping involves grading high areas and/or placing additional soil in depressions and compacting it in order to meet USACE levee design criteria for side slopes and crown width. For the RP, the minimum crest width is 20 feet for major tributary levees and 12 feet for minor tributary levees. Existing levees with landside and waterside slopes as steep as 2H:1V (for every 2 feet of horizontal distance, there is a 1 foot increase in height) may be acceptable if slope performance is good and if stability analyses determine the factors of safety to be adequate. Otherwise, the landside and waterside slopes should have 3H:1V slopes.

Preparation

Prior to construction, the waterside levee crest edge would be cleared and grubbed and the crown and existing landside slope would be stripped to remove 0.5 to 1 foot of material (up to 2 feet) depending on local conditions.

Construction

To correct levee geometry, suitable material would be placed along the landside to provide minimum slope, required height and crest width to meet USACE levee design criteria. After construction, slopes would be hydro-seeded for erosion control.

The additional area added to the landside toe varies from 1 to 30 feet, depending on the existing width of the levee. The slope reshaping typical plan is shown in Figure 4-2. Slope reshaping and levee height fixes may require relocation of landside toe drains and ditches, which would be reestablished landward of the improved levee toe and would continue to function as they did before levee improvements were constructed. Levee slope reshaping may require removal of erosion protection such as rock revetment. Upon completion of reshaping, erosion protection would be replaced.

Equipment

The equipment used would be similar to that used for levee raising.

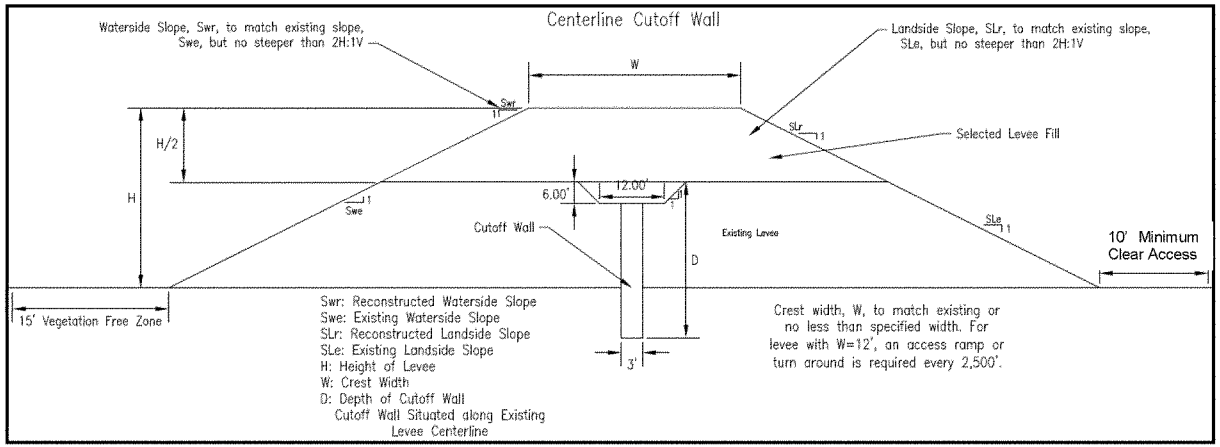


Figure 4-1: Cutoff Wall Typical Plan

Note that the landside easement (right side) shown would be the minimum easement; landside easements would range from 10 feet to 20 feet from the levee toe.

4.3.3 LEVEE RAISE (LEVEE HEIGHT FIX)

Description

To raise levees, borrow material would be added after cutoff walls and levee reshaping improvements are completed (Figure 4-2). Material would be spread evenly and compacted according to levee design plans. The levee would be hydro-seeded once construction was completed. In some locations, the height could increase up to 5 feet; however, most raises would be 1.5 to 3 feet. An increase in levee height may require additional levee footprint area to meet design requirements.

Preparation

Prior to construction, the waterside levee crest edge would be cleared and grubbed, and the crown and existing landside slope would be stripped to remove 0.5 to 1 foot of material (up to 2 feet) if local conditions warrant. The levee raise involves scraping or ripping the existing levee and placing and compacting additional soil material in those areas.

Construction

Suitable material would be placed along the crown and landside of the existing levee, where needed, to provide the minimum slopes, required height and crest width that meet USACE levee design criteria. Fill materials would then be compacted to the design specification. The typical plan for a levee raise is shown in Figure 4-2.

Equipment

A hitched scraper, hitched discs or hitched ripper are examples of what might be used to loosen existing material in order to achieve a bond between new soil material and the existing levee. Other equipment likely to be used during the process would be a water truck, a grader, belly dump trucks, a bulldozer, a manual compactor or a sheep's foot roller.

4.3.4 Seepage Berm

A seepage berm is typically built adjacent to the landside of the levee and consists of layers of sand, gravel and soil. The purpose is to control seepage flows and reduce the risk levee undermining during a high-water event. The seepage berm acts as a cap, controlling flow below the berm surface and allowing it to reach an exit location such that the undermining of levee soils is reduced or eliminated, thereby preventing boils and piping near the levee.

The seepage berm width could range from 100 to 200 feet from the landside toe of the levee (maximum width of 300 feet). It would be 5 feet thick at the toe of the levee and gradually slope downward to about 3 feet at the landside edge, with a 3:1 slope to ground level.

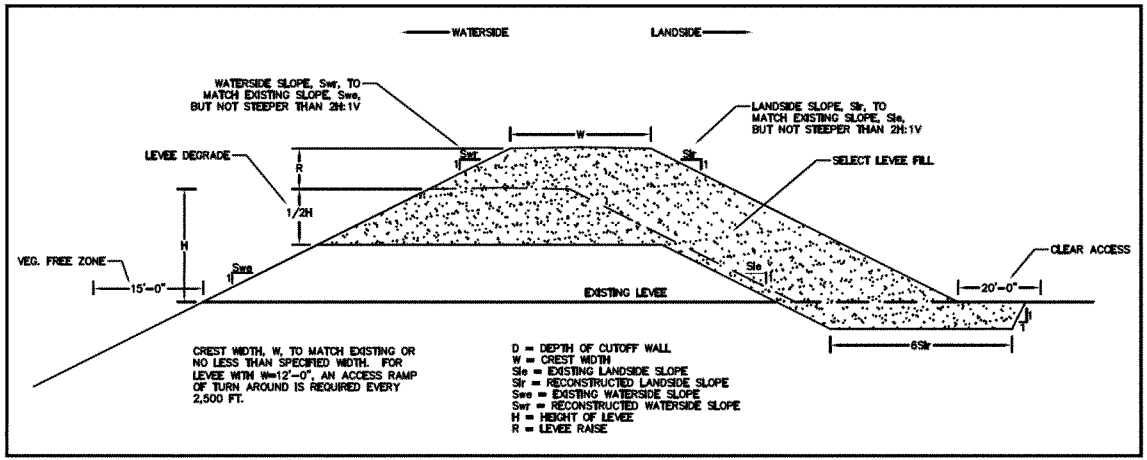


Figure 4-2: Levee Reshaping and Levee Raise Typical Plan

Note that the landside easement (right side) shown would be the maximum clear access easement; landside easements would range from 10 feet to 20 feet from the levee toe. Half levee degradation is generally not proposed unless a cutoff wall would be installed. Instead, an internal drain may be constructed between the existing levee materials and the new fill.

Prior to construction, the landside area would be cleared and grubbed for the new berm, right of way and temporary easement. A layer of sand would be placed to help eliminate the movement of fine-grained materials from underneath the levee. Gravel would be placed on top of the sand to create a drainage layer to allow water to flow in a controlled manner and exit the face of the seepage berm to reduce pressure on the landside of the levee. A soil layer would be placed on top of the gravel to further reduce the risk of seepage flows. Filter fabric would be placed between the soil and gravel layer to avoid migration of the soil into the gravel, which could clog the gravel and reduce its ability to carry seepage flows. A typical plan for a seepage berm is shown on Figure 4-3.

4.3.4 NEW LEVEE

Description

This measure involves new construction to reduce flood risk to areas or to prevent waters from outflanking (flowing around the ends of the levees and entering the protected area) the levee system during high water events. Under Alternatives 7a, 8a and 9a, a new levee would be constructed on the upstream 0.75 mile of Duck Creek to tie the existing levee into the railroad berm on the north side of Duck Creek.

New Setback Levee with Cutoff Wall and Existing Levee Degrade. A new levee would be constructed to include a cutoff wall and would be used along the western portion of Fourteenmile Slough. The existing levee would be partially degraded (about half way) and a new levee constructed landward of the remnant existing. The land between the remnant levee and new levee would become a mitigation planting area to offset project environmental impacts. About 14 acres of habitat would be created between the existing levee and the VFZ of the new landside levee. The length of the offset area would be 1.33 miles and the width would vary from about 60 feet to 90 feet.

Preparation

The construction footprint would be cleared and grubbed and a new levee foundation excavated. An inspection trench would be excavated across the entire proposed centerline of the new levee. The trench depth would depend upon levee height, as required by USACE guidance and the State's Urban Levee Design Criteria (ULDC). For the purposes of the impact analysis, a depth of 3 to 6 feet is assumed.

New Setback Levee with Cutoff Wall and Existing Levee Degrade. The area would be cleared and grubbed and material obtained from degrading the top half of the levee would extend up to 60 feet beyond the existing levee. It would be compacted such that the material forms an extension to the existing levee. The degraded material would be placed landward.

Construction

Construction of the new levee would conform to USACE levee design criteria, with suitable material placed in 6 to 8 inch lifts, moistened and compacted to specification until the design elevation is reached. A cutoff wall would be constructed through the new levee center, if needed, to prevent through and under seepage. For any required erosion protection, quarry stone riprap would be applied to armor the levee's waterside slope. Fill material would be obtained and delivered using haul trucks. A gravel road would be constructed on the crown of the new levees. After construction, levee slopes would be reseeded with natural grasses to prevent erosion. A typical plan for a new levee with a cutoff wall is in Figure 4-4.

4.3.5 EROSION PROTECTION

Description

The new erosion protection would be placed either on the waterside of the levee or on the landside, above the waterline. The North Stockton erosion protection's purpose is to protect the project from wind and wave run-up erosion that could occur if Delta levees west of the project levee were to fail. The purpose of the Central Stockton erosion protection on Duck Creek is to protect the landside from erosion that could occur if floodwaters moving from the south to the northeast were to wrap around the end of the project levee and back up against it. Although this would be the only new erosion protection, any existing riprap disturbed during construction would be replaced.

Construction

Riprap was used to describe erosion protection features and the associated impacts. Approximately 75,000 tons of imported quarry stone would be placed to a thickness of 2 feet along the landside to prevent wind wave erosion. A sand filter would also be placed prior to the riprap layer to prevent gravel instability and decreased erosion protection performance. In PED, other erosion protection methodologies besides riprap may be explored.

Equipment

A dump truck or belly dump is likely the predominant piece of equipment that would be used to transport the rock. A hydraulic excavator would be used to settle the rock into place. Rock can also be placed from a barge using a hydraulic excavator. A dozer may be necessary following the barge unloading to settle the rock into place.

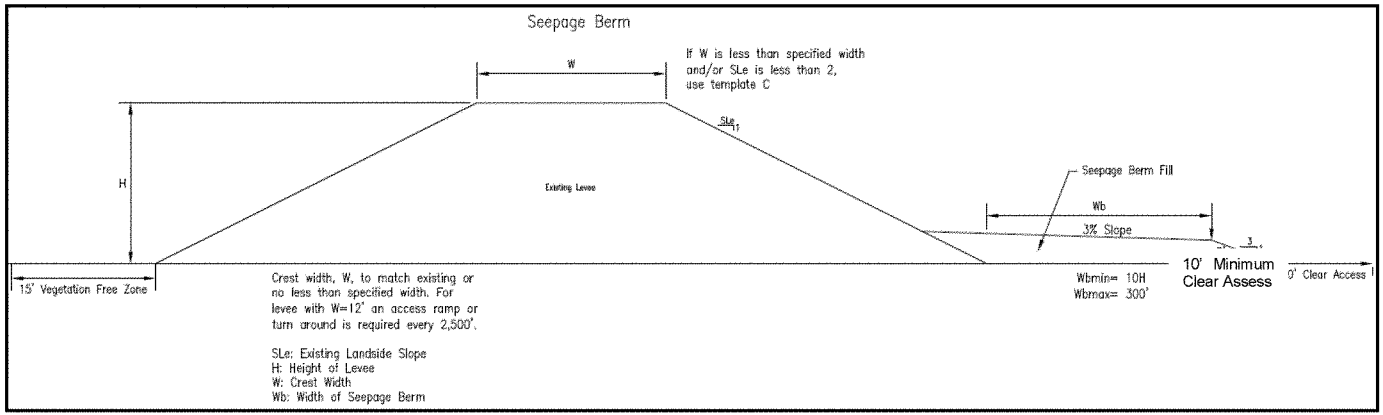


Figure 4-3: Seepage Berm Typical Plan

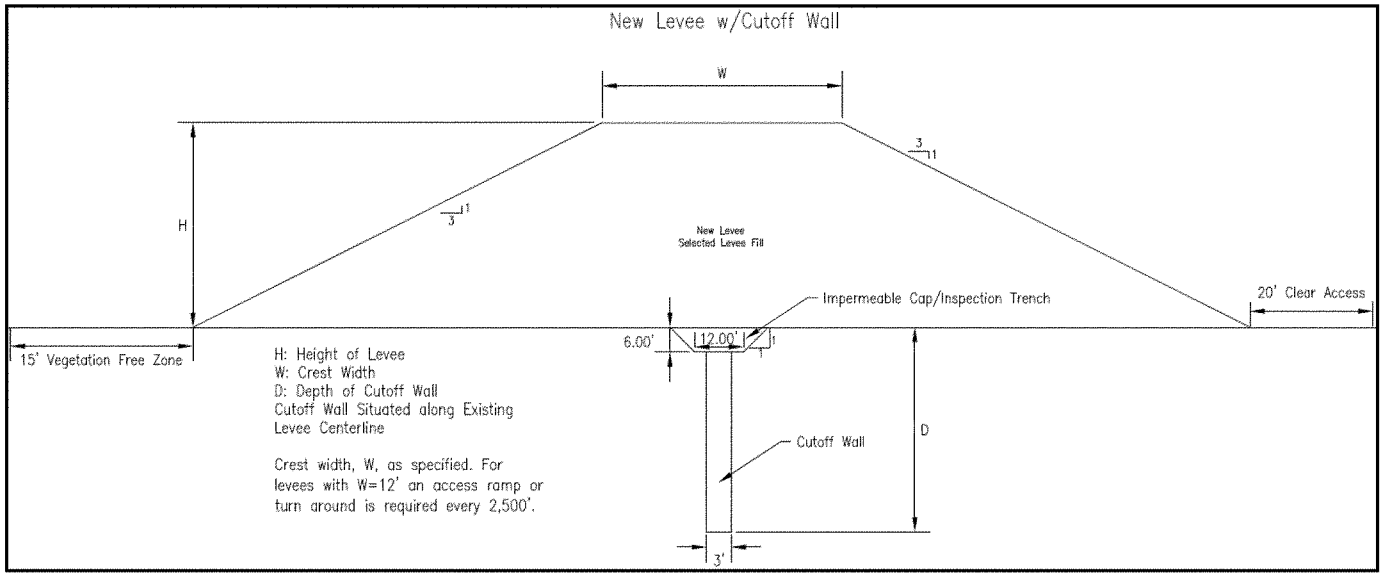


Figure 4-4: New Levee with Cutoff Wall Typical Plan

4.3.6 FLOODWALL

Floodwalls are an efficient, space-saving method for containing unusually high water surface elevations. They are often used in densely developed areas with limited space. This measure would construct about 0.2 mile of sheet pile floodwall from the southern portion of Dad's Point to high ground at Louise Park adjacent to the boat launch. The wall height would be an average of 3 to 4 feet above the ground surface. A metal cap may be placed on the top of the sheet pile or the sheet pile may be encased in concrete. The floodwall would be 5- to 8-inches wide.

Preparation

To begin construction, the area would be cleared, grubbed, stripped and excavated to provide space for the footing of the floodwall.

Construction

The floodwall would primarily be constructed from pre-fabricated materials, though it may be cast or constructed in place almost completely upright. Floodwalls mostly consist of relatively short elements, designed to disturb a minimal amount of waterside vegetation. The height would vary from 1 to 4 feet as required by water surface elevations. The waterside slope would be re-established to its existing slope and the levee crown would grade away from the wall and be surfaced with aggregate base.

4.3.7 NEW BRIDGES

Three bridges would be constructed over Mormon Channel Bypass to replace low water road crossings that are periodically inundated. This measure is included in Alternatives 9a and 9b and would include removing the existing road and grading the area to allow flood flows to move unimpeded from the Stockton Diverting Canal through the Mormon Channel Bypass and then into the San Joaquin River.

4.3.8 SEISMIC REMEDIATION

The Delta Risk Management Strategy (DRMS) conducted by Californian Department of Water Resources (DWR) in 2008 identified the vulnerability of San Joaquin Delta levees to seismically-induced cracking and slumping, which could lead to flooding particularly where levees are loaded every day. Site-specific liquefaction triggering analysis performed by USACE for the LSJRFS identified localized reaches that are vulnerable to liquefaction under earthquake loading from an event with a 0.005 probability of occurring in any year (recurrence interval of 200 years). Subsequent to USACE seismic evaluation DWR conducted liquefaction and deformation analysis in the LSJRFS study area using additional information from borings and cone penetration tests (CPTs). The following conclusions are based on a combination of USACE and DWR analysis.

Based on existing foundation data and analysis the northern-most corner of the Stockton North impacted area, which also experiences a daily load of 6 feet of water, is not susceptible to liquefaction and slope failure induced by a seismic event. The data on which this conclusion is based, however, is from the east side of Fourteenmile Slough. Although it is reasonable to expect that foundation conditions on the west side of Fourteenmile Slough are similar, there is some uncertainty since no investigations exist on the west side. A preliminary alternative was considered to fix in place on the east side and extend the existing Lincoln village levee to address flooding from the Delta. It was deemed unjustified because it required a longer length of levee to go around Fourteenmile Slough and it would require the acquisition of a large number of homes (well

over 100). The levee on the west side with a closure structure for Fourteen mile Slough was the more cost-effective solution.

Based on existing data and analysis the southern-most (southwest) corner of the Stockton North impacted area, which experiences a daily load of 5 feet of water, is susceptible to liquefaction and slope failure induced by a seismic event with a recurrence interval of 200 years. The vulnerable reach is located on the San Joaquin River just downstream of the confluence with the Calaveras River (Figure ES-1). This portion of the San Joaquin River is a deep water ship channel (DWSC) flanked by high steep levees which are tidally loaded to elevation 6 feet daily. The landside toe elevation is as low as 1 feet and portions of the Stockton North impact area are below elevation 0 (Figure 2-1). The daily load in terms of head above the landside levee toe is 5 feet and will increase with sea level rise since the Delta is connected to the Pacific Ocean. The population of Stockton North impact area is 83,000 people (Figure 3-18: North Stockton Residual Risk). The reach also includes the East Bay Municipal Utility District (EBMUD) water pipeline crossing of the DWSC. Seismically induced liquefaction and slope failure could flood the Stockton North impact area, close the Stockton DWSC, and sever the EBMUD water pipeline.

The DWR analysis cross section at Station 95+00 identifies a likely liquefiable sand layer 16 feet thick extending from elevation -15 to -31 feet and extending laterally into the ship channel. Stability analysis of the waterside slope using post-seismic strengths for the liquefiable layer (but no acceleration) results in a factor of safety of 0.85. Because the factor of safety is less than one the sand layer is expected to flow into the ship channel taking the levee with it; under the flow condition the deformed height of the levee cannot be predicted. The daily high tide of 6 feet could overtop the damaged levee or initiate a piping failure through cracks in the levee. Given these foundation conditions and potential consequences, the PDT determined that it was necessary to include seismic remedial measures for 5600 linear feet in the project description and baseline cost estimate in order to meet engineering requirements. No other segments requiring seismic mitigation have been identified.

Mitigation for liquefaction usually entails compacting, densifying, or encapsulating the liquefiable layer. The mitigation measure used for the baseline cost estimate encapsulates the liquefiable layer by constructing a series of cells using deep soil mixing. This mitigation measure is common to all of the alternatives accept the no action alternative. Because the liquefiable layer is well below normal river level direct excavation and compaction is not feasible. Another compaction method called deep dynamic compaction is not recommended because it involves dropping a large weight from a crane and the vibration could induce liquefaction and slope failure. Stone columns are a common method to densify liquefiable layers and relieve pore water pressure upward through the columns. The lack of confinement on the waterside would limit densification and seepage through the columns could impact levee performance. Stone columns are installed using vibration which could cause settlement of the levee during construction. Encapsulation by constructing deep soil mixing cells was selected as the best approach due to the narrow construction footprint between the deep water ship channel and the residential development and the disadvantages of the other methods considered.

Description

This technique is meant to keep the levee from deforming or liquefying during seismic activity. It would be implemented to provide seismic stability to the Stockton Deep Water Ship Channel where it is vulnerable to liquefaction, retains a permanent pool, and protects the Brookside neighborhood as well as the East Bay Municipal Utility District water supply pipeline. It would involve installation of a grid of drilled soil-cement mixed columns (Figure 4-5). There would be a series of overlapping, DSM columns aligned longitudinally with and transverse to the alignment of the levee extending beyond the levee prism. This measure would also reduce risk of seepage and provide improved landside slope stability.

Construction

The crest of the levee would be reconstructed to comply with the USACE levee design criteria. A determination may be made during the future design that all the degraded material may not be necessary to extend the levee to the proposed toe. The proposed toe could be located along an imaginary line extending from the landward face of the proposed levee to existing grade. During the current feasibility planning, the maximum extent of the reconstruction berm is shown in order to show the maximum impacts that could occur.

DSM augers would be used to construct a continuous grouping of cells spaced equally in both longitudinal and transverse directions to the levee alignment (Figure 4-5). A hose attached to the auger would inject cement bentonite slurry into the soil, allowing for DSM. After construction is completed, the levee crest would be topped with a 6-inch aggregate road and the slopes would be hydro-seeded for erosion control.

The location of the individual columns and the pressures to be used during construction will be defined during PED, if the project is authorized and funded. Column locations will be placed to minimize chances that the soil-cement mixture would be released into the environment (frac-out).

Equipment

A truck mounted with a mechanical DSM auger, a cement bentonite equipment mixer and a pump delivery system would be used.

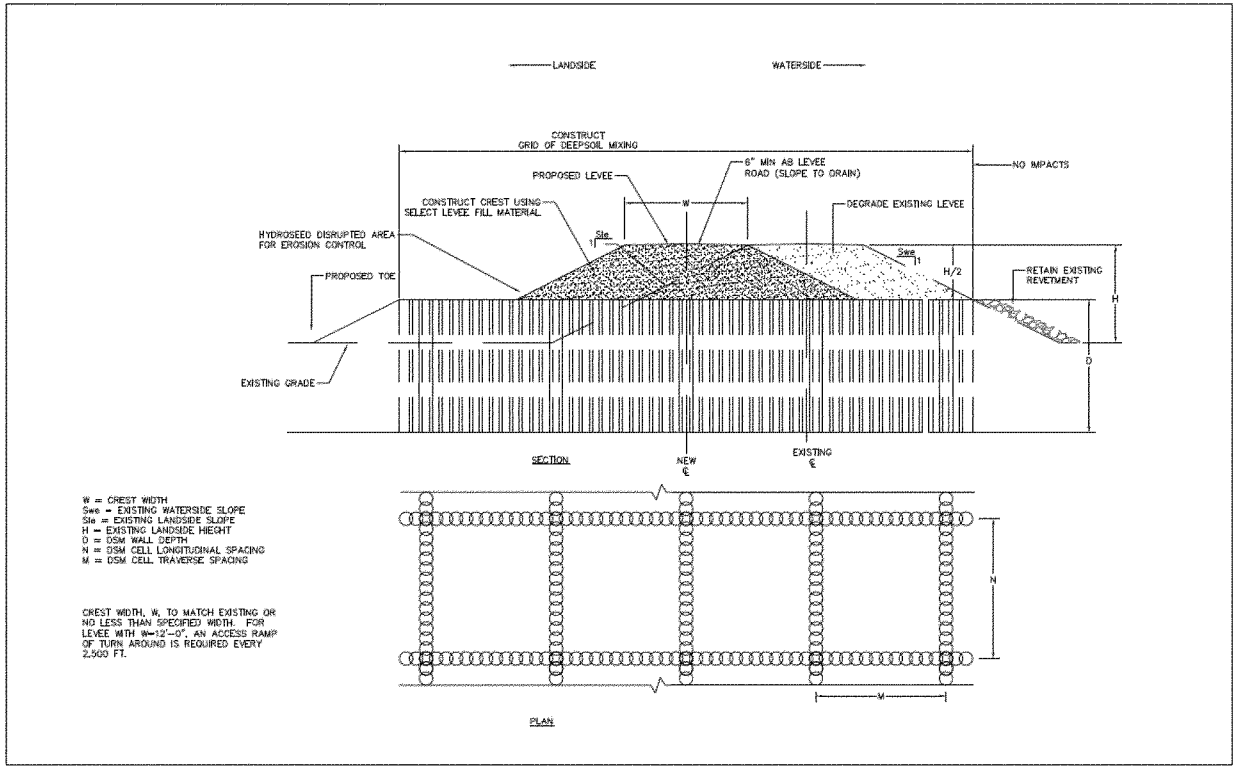


Figure 4-5: Seismic Remediation Typical Plan

4.3.9 CLOSURE STRUCTURES

Description

This measure would include construction of closure structures at the mouth of backwater sloughs at Smith Canal and on Fourteenmile Slough to reduce flood risk. The Smith Canal structure would extend from the end of Dad's Point to the right bank of the San Joaquin River at the Stockton Golf and Country Club. The Fourteenmile Slough closure structure would extend across Fourteenmile Slough about 0.3 miles west of Fivemile Slough. The closure structures would control back-flooding from the San Joaquin River and Delta during high water events.

The proposed structure for Smith Canal would consist of a fixed sheet pile wall (about 800 feet long) with an opening gate sufficiently large to allow for the safe passage of boats and other watercraft. Fish and other aquatic organisms would be able to pass through these gates when they are open. The opening portion of the gate would be automated and may open upward or outward. The gate would be 50-feet wide and attached to a concrete foundation. A small building, about 400 square feet, would be built at the end of Dad's Point, directly adjacent to the closure structures, designed to store equipment required to operate the gate. As needed, a sheet pile floodwall would be constructed adjacent to the control structures to tie the structures into the adjacent levee or high ground areas.

The elements discussed above are specifically for Smith Canal and are assumed to generally apply to the Fourteenmile Slough closure structure. During PED, further evaluation would be completed to confirm or adjust these assumptions.

Preparation

Construction of sheet pile walls on land would require that clearing and grubbing of vegetation for a 35-feet wide footprint. Survey markings could be expected post clearing and grubbing. Preparation for construction would require a working platform (barge) and a tug boat in order to move the barge around. The survey equipment for use in and around water would likely be a laser guided system.

Construction

Construction would not require dredging, drag-lining or in-water excavation. The in-water work would be accomplished without use of a separate cofferdam. The cofferdam and permanent sheet pile are identical, except for the gate construction where the sheet pile will be cut away upon completion of the concrete structure. The "wing" structures supporting the operable gates and related floodwalls would permanently block a portion of each of these waterways.

The following are the details of the sheet pile installation and miter gate installation on Smith Canal. The closure structure on Fourteenmile Slough would be a scalable version of the Smith Canal, to be determined in PED. However, Fourteenmile Slough may require pumping capacity in order to evacuate water from the slough during high water events.

For the dual sheet pile wall construction:

1. Two sheet pile walls would be parallel to each other and 20 feet apart. They would install the same way as a single sheet pile wall is installed. The south dual sheet pile would be installed during the first in-water construction season beginning June 30. Once the miter gate is operational, the north section of the dual sheet pile wall would be installed in the following year's in-water construction season.
2. The space between the dual sheet piles would be dewatered for installation of cross ties, bracing and gated culverts between the two sheet pile walls.
3. Granular fill material would then be placed between the two sheet pile walls without dewatering up to 3 feet of the top of the dual sheet pile walls.
4. Total installation time for the dual sheet piles is about 4 months.

For the miter gate construction:

1. A metal sheet pile cofferdam is required to allow dry work to occur on the walls and foundation of the gate. The cofferdam sheet piles would be formed for the foundation of the gate structure (70 ft by 70 ft). This takes 3 weeks to install.
2. Once the coffer dam is installed, dewatering of the sheet pile would occur and a small amount of dewatering would continue during installation of the gate structure.
3. Concrete cylinder piles (24 inch diameter) would be driven inside the coffer dam using an impact hammer to provide support for the concrete floor and walls.
4. Reinforced concrete floor and walls would be formed and placed using the cylinder piles for support.
5. A metal gate would be attached to the concrete floor and walls. Installation of the gate foundation, walls and miter gate would take 6 months.
6. Two sides of the coffer dam would be used to form the walls of the gate structure. The remaining two sides that block the navigable openings of the gate would be cut by divers at the sides of the wall and top of the gate foundation to provide the necessary opening.

Equipment

The equipment necessary for work in the water would include a barge as a working platform for the installation process and a tug boat for the movement and correct placement of the barge. Once a desired location is established, an anchoring system would be necessary for the barge during installation of the sheet pile wall. The tug would remain nearby during the construction.

The installation of the sheet pile wall would require that a crane be assembled on the barge. A vibratory hammer would be installed at the end of the crane. Depending on the depth necessary for installation, a vibratory hammer may not have the driving power necessary for complete installation; an impact hammer may be needed in order to reach the depths necessary to fully install the sheet pile. Installation of the sheet pile wall on land will require the use of an impact hammer to get the walls to the proper depth.

The construction of the gate structure would require support piles to be installed for the foundation of the closure gate. The support piles would require that an impact hammer be used to drive the piles to the proper depth.

After the installation of the walls and piles, the barge would continue to be used to ferry construction workers and small equipment to various points to complete installation of the wall and the closure gate foundation. The platform for the closure gates would be a pre-cast, ready-to-install floor or the floor could be formed and concrete placed onsite. The walls could also be pre-cast or formed and placed onsite. The equipment and materials needed for construction would be ferried to the site.

The elements discussed above are specifically for Smith Canal and are assumed to generally apply to the Fourteenmile Slough closure structure. During PED, further evaluation would be completed to confirm or adjust these assumptions.

4.3.10 CONTROL STRUCTURE AND BYPASS CHANNEL

This measure involves re-watering Old Mormon Slough (below the Stockton Diverting Canal) as a FRM bypass (Mormon Channel Bypass). Installing a diversion structure on the left downstream bank of the Stockton Diverting Canal would divert up to 1,200 cfs down Mormon Channel Bypass. The flows diverted would otherwise go through the Stockton Diverting Canal to the Lower Calaveras River and out into the San Joaquin River/Stockton DWSC. The design would divert the maximum flow that could be handled by the channel without levees or floodwalls. Implementation of these measures would reduce water levels during flood events on the Stockton Diverting Canal and the Calaveras River, as well as provide some ER benefits to the Mormon Channel Bypass.

Channel improvements would be required under this measure. The Mormon Channel Bypass improvements would begin at the Stockton Diverting Canal and would continue downstream approximately 6.3 miles. Most of the low-water crossings would be removed or replaced with bridges to maintain service during flood operations and reduce head losses at the crossings. In addition, several reaches must be enlarged by removing fill and encroachments in order to reestablish channel capacity. Other work would include construction of a floodwall around an existing building and installation of two additional culverts at the Southern Pacific Railroad (SPRR) crossing.

The control structure would be a box culvert constructed in the existing Stockton Diverting Canal levee to divert flows from the Stockton Diverting Canal to the Mormon Channel Bypass. A 12-foot radial gate would be used to control Mormon Channel flows to no greater than 1,200 cfs. The gate would be automatic and operate based on real-time gage flows. A plan of the proposed control structure is in Figure 4-6.

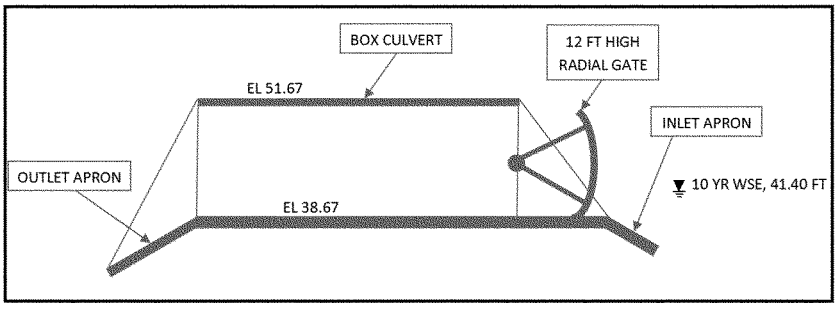


Figure 4-6: Mormon Channel Bypass Control Structure

4.3.11 JET GROUTING

Description

Jet grouting is typically used in constructing a cutoff wall to access areas other methods cannot. It is typically a spot application rather than a large scale treatment. Jet grouting would be used around existing utilities not proposed for removal and at bridges along levees in the project area. It involves injecting fluids or binders into the soil at very high pressure. The injected fluid can be grout; grout and air; or grout, air and water. Jet grouting breaks up soil and, with the aid of a binder, forms a homogenous mass that solidifies over time to create low permeability.

Preparation

To provide a wide enough working platform on the crown, the upper portion of some segments of levee may require degradation with a paddle wheel scrapper. Material would be scraped and stockpiled nearby. Hauling would involve scraper runs to the staging area and grout, bentonite and water deliveries to the batch plant.

Construction

To initiate jet grouting, a borehole would be drilled through the levee crown and foundation to the required depth (to a maximum of 130 feet) by rotary or rotary-percussive methods using water, compressed air, bentonite or a binder as the flushing medium. A high pressure pump would convey grout, air and/or water through pipelines to the drill string, to a set of nozzles located just above the drill bit. Smaller equipment could be used in combination with the single phase–fluid system and could be permanently trailer-mounted to permit efficient mobilization and easy movement at the job site. During this process, the drill string is rotated and slowly withdrawn. Use of double, triple and superjet systems create eroded spoil materials that would be expelled out of the top of the borehole. The spoil material would contain significant grout content and could be used as a construction fill.

Jet-grouted columns range from 1 to 16 feet in diameter and are interconnected to form cutoff barriers or structural sections. One construction crew, consisting of a site supervisor, pump operator, batch plant operator, chuck tender and driller, can construct 2 6-feet-diameter, 50-foot columns per day consisting of 100 cubic yards of grout injected per 8-hour shift. Ideal conditions would be characterized by no technical issues such as loss of fluid pressure, breakdown of equipment or subsurface obstructions occurring at either the batch plant or the drilling site.

Equipment

Equipment required for jet grouting consists of a drill rig fitted with special drill string; a high pressure, high flow pump; an efficient batch plant with sufficient capacity for the required amount of grout and water; supporting generators; air compressors; holding tanks; water tanks; and bulk silos of grout typically used to feed large mixers.

4.3.12 ENCROACHMENTS

Utility encroachments such as structures, certain vegetation, power poles, pump stations and levee penetrations (e.g., pipes, conduits, cables) would be brought into compliance with USACE policy or removed depending on type and location. This would include the demolition, relocation or reconstruction as appropriate (or retrofit to comply with standards). Utility replacements would occur via (1) a surface line over the levee prism or (2) a through-levee line equipped with positive closure devices.

No real property has been definitively identified for acquisition at this time. In the PED phase of the project following Congressional authorization, site-specific analysis would be conducted prior to construction to determine specific impacts to include encroachment removal. In preparing real estate acquisition boundaries for the NFS, encroachment removal will be avoided to the greatest extent possible consistent with the real estate requirements for the project.

4.4 ALTERNATIVES

4.4.1 ALTERNATIVE 1 – NO ACTION

Under No Action, USACE would not participate in improvements to the existing FRM in the study area. Although State or local agencies would likely repair area levees in the future to meet Federal (FEMA) or State (SB 5 200-year protection) flood protection obligations, this alternative assumes that FRM measures would not be implemented and that the current level of risk would continue. This risk, as represented in the study analysis area, would leave both residents and property in and near the Cities of Stockton, Lathrop and Manteca vulnerable to flooding.

In response to major floods in the early 1950s, USACE constructed several dams, miles of levees and other features in and near the study area as part of the Lower San Joaquin River and Tributaries project. Since then, the engineering performance and potential reliability of these projects were reexamined due to greater understanding of operational processes, including through and under seepage, slope stability, overtopping and erosion. Under No Action, these processes would continue and likely become worse, increasing the risk of future levee failure during high flows.

Climate change also appears to be affecting worldwide temperatures and seasonal climate patterns. Projections show rises in sea level and changes in inland climate patterns that could result in higher, future water-surface elevations in the San Joaquin River and tributaries. An estimated 235,000 residents and $28.7 billion in damageable property would continue to be at risk of unexpected levee failure and flooding in the study area.

Existing environmental resources, particularly native vegetation, wildlife, special status species and water quality are also at risk from levee failure and flooding. Adverse effects could include future loss or damage to terrestrial and/or aquatic habitats.

4.4.2 ALTERNATIVES 7A (RECOMMENDED PLAN) AND 7B – NORTH AND CENTRAL STOCKTON, DELTA FRONT, LOWER CALAVERAS RIVER, SAN JOAQUIN RIVER LEVEE IMPROVEMENTS AND RD 17 LEVEE IMPROVEMENTS (ALTERNATIVE 7B ONLY)

Under Alternatives 7a (RP) and 7b, levee improvements consist of measures described in Section 4.3. Alternative 7a is also shown on Figure 3-8. Alternative 7b is shown on Figure 3-9. Tables 4-2 through 4-4 summarize the measures proposed per separable area and waterway.

Table 4-2: Action Alternatives Measures by Waterway—North Stockton

			Action Alternatives					
Waterway	**Reach**	**Proposed Measure(s)**	**7a**	**7b**	**8a**	**8b**	**9a**	**9b**
Mosher Slough	Shima Tract to Thornton Road	Cutoff wall Levee height fix (sea level rise)	X	X	X	X	X	X
Shima Tract	Mosher Slough to Fivemile Slough	Cutoff wall Erosion protection (landside)	X	X	X	X	X	X
Fivemile Slough	Shima Tract to Fourteenmile Slough	Cutoff wall Erosion protection (landside)	X	X	X	X	X	X
Fourteenmile Slough	Fivemile Slough to Proposed Closure Structure	Slope Reshaping Levee height fix (sea level rise) Erosion protection (landside)	X	X	X	X	X	X
Fourteenmile Slough	Approximately 1,500 feet west of Fivemile Slough	Closure Structure	X	X	X	X	X	X
Fourteenmile Slough	Approximately 1,250 feet southeast setback out from proposed closure structure	Levee height fix (sea level rise) Erosion protection (landside)	X	X	X	X	X	X
Fourteenmile Slough	From setback cut south to Tenmile Slough	With Setback Slope Reshaping Erosion protection (landward)	X	X	X	X	X	X
Tenmile Slough	Fourteenmile Slough to March Lane	Cutoff wall Slope Reshaping Erosion protection (waterside)	X	X	X	X	X	X
Tenmile Slough	March Lane to West March Lane/Buckley Cove Way	Seismic Fix Slope Reshaping Erosion protection (waterside)	X	X	X	X	X	X
Tenmile Slough/ Buckley Cove Marina/ San Joaquin River	West March Lane/Buckley Cove Way/to Calaveras River	Seismic Fix Slope Reshaping	X	X	X	X	X	X
Calaveras River – Right/North Bank	San Joaquin River to North El Dorado Street	Cutoff wall	X	X	X	X	X	X
Calaveras River – Right/North Bank	North El Dorado Street to railroad tracks	Cutoff wall Slope Reshaping Height Fix			X	X		
Calaveras River – Right/North Bank	Railroad tracks to approximately Cherryland Avenue	Cutoff wall			X	X		

Table 4-3: Action Alternatives Measures by Waterway—Central Stockton

			Action Alternatives					
Waterway[1]	**Reach**	**Proposed Measure(s)**	**7a**	**7b**	**8a**	**8b**	**9a**	**9b**
Calaveras River – Left/South Bank	San Joaquin River to approximately I-5	Cutoff wall	X	X	X	X	X	X

Calaveras River – Left/South Bank	Approximately I-5 to approximately North Pershing Avenue	Cutoff wall Slope Reshaping	X	X	X	X	X	X
Calaveras River – Left/South Bank	Approximately North Pershing Avenue to approximately El Dorado Street	Cutoff wall	X	X	X	X	X	X
Calaveras River – Left/South Bank	Approximately El Dorado Street to the Stockton Diverting Canal	Cutoff wall			X	X		
Stockton Diverting Canal	Calaveras River to Old Mormon Slough	Cutoff wall			X	X		
San Joaquin River	From approximately 2,100 feet upstream of the Calaveras River to the proposed Smith Canal Closure Structure	Cutoff wall Levee height fix (sea level rise)	X	X	X	X	X	X
Smith Canal	At the mouth of the canal between Stockton Golf and Country Club and Dad's Point	Closure Structure	X	X	X	X	X	X
Smith Canal	Dad's Point from the Closure Structure to approximately 375 feet down Monte Diablo Avenue	Floodwall	X	X	X	X	X	X
Old Mormon Slough	Port of Stockton to Stockton Diverting Canal	Diversion structure Channel improvements Flood Bypass channel					X	X
San Joaquin River	Railroad bridge just upstream of the Port of Stockton to Burns Cutoff	Cutoff wall Slope Reshaping	X	X	X	X	X	X
San Joaquin River	Burns Cutoff to French Camp Slough	Cutoff wall	X	X	X	X	X	X
French Camp Slough – Right/North Bank	French Camp Slough confluence with the San Joaquin River to approximately 500 feet southwest of I-5[2]	Cutoff wall	X	X	X	X	X	X
Duck Creek	500 feet past I-5 cross to approximately Odell Avenue	New levee	X		X		X	
Duck Creek	Approximately Odell Avenue to McKinley Avenue	Cutoff wall Levee reshaping Levee Height Fix	X		X		X	

[1] Note that for the purposes of the impact assessment in Chapter 5, all improvements to levees on the Calaveras River are considered as part of Central Stockton. This was in recognition of the importance of considering the Calaveras River, including both banks, as an ecologically meaningful whole.
[2] Note that specific sections of this reach have been repaired by RD 404 and will be excluded from the RP.

Table 4-4: Action Alternatives Measures by Waterway—RD17

Waterway	Reach	Proposed Measure(s)	Action Alternatives					
			7a	7b	8a	8b	9a	9b
French Camp Slough – Left/South Bank	San Joaquin River to approximately 600 feet southeast of Carolyn Weston Boulevard	Cutoff wall		X		X		X
San Joaquin River	French Camp Slough to approximately Dos Reis Road	Cutoff wall Slope Reshaping Height fix		X		X		X
San Joaquin River	Approximately Dos Reis Road to the levee access road at the northern termination of Lathrop Road	Seepage berm Levee reshaping Height fix		X		X		X
San Joaquin River	From the levee access road at the northern termination of Lathrop Road to the levee access road at the southern termination of Lathrop Road	Cutoff wall Slope Reshaping Height fix		X		X		X
San Joaquin River	From the levee access road at the southern termination of Lathrop Road cutting off the oxbow due south	New levee Erosion protection		X		X		X
San Joaquin River	From the new levee to approximately Chiavari Way	Seepage berm Levee reshaping Height fix		X		X		X
San Joaquin River	From Chiavari Way to the existing termination of the tie back levee	Cutoff wall Slope Reshaping Height fix		X		X		X
San Joaquin River	From the existing termination of the tie back levee to approximately South Tinnin Road	New levee		X		X		X
San Joaquin River	From approximately Woodward Road to the termination of the new tie back levee	Erosion protection		X		X		X

North Stockton Area

Levee Improvements

The North Stockton area includes improvements to the Mosher Slough south levee, Shima Tract east levee, Fivemile Slough/Fourteenmile Slough north levee, Fourteenmile Slough west levee, Tenmile slough east levee, Calaveras River north/right levee and San Joaquin River east levee. For the purposes of the impact assessment in Chapter 5, Calaveras River improvements are considered within Central Stockton. The measures proposed to improve the levees include cutoff walls, setback levee with cutoffwall and existing levee degrade, levee height fixes, erosion protection, and slope reshaping. For the Calaveras River, 4.25 miles of the north bank (to approximately El Dorado Street) would be improved with a combination of cutoff walls, slope reshaping and height fixes. In addition, a closure structure would be installed across Fourteenmile Slough, 1,500 feet west of Fivemile Slough. These measures are described in Section 4.3. The locations of each fix are shown on Figures 3-8 and 3-9 and summarized in Table 4-2. For the purposes of the impact assessment in Chapter 5, the Calaveras River north/right bank improvements are considered together with the Calaveras River south/left bank improvements under Central Stockton.

Closure Structure on Fourteenmile Slough

In addition to the levee improvement measures, there is also a closure structure proposed for Fourteenmile Slough. It would be located across Fourteenmile Slough from the Fivemile Slough/Fourteenmile Slough north (right) levee to the Fourteenmile Slough south/west (left) levee and consistent with the design described in Section 4.3.10.

This portion of the study area has a high risk of seismic events. Also, operation of the closure structure would limit water saturation levels in during high water, which would reduce the risk of levee damage from both seismic and high water events.

Central Stockton Area

Levee Improvements

The Central Stockton area includes levee improvements to the Calaveras River, San Joaquin River, Smith Canal and French Camp Slough. For the Calaveras River, 3.3 miles of the south bank (to approximately Pacific Street) would be improved with a combination of cutoff walls, slope reshaping and height fixes, described in Section 4.3. The locations of each fix are shown on Figures 3-8 and 3-9 and summarized in Table 4-3. For the impact assessment in Chapter 5, Calaveras River north/right bank improvements are considered under Central Stockton.

Closure Structure on Smith Canal and Floodwall on Dad's Point

In addition to levee improvements, a closure structure would be installed across the mouth of Smith Canal from the San Joaquin River east levee at Brown's Island to the end of Dad's Point. A floodwall (about 3 to 5 feet high) would also be constructed on Dad's Point to tie the closure structure into the high ground on the shoreline. The design would be consistent with the measure described in Section 4.3. The closure structure would prevent inflow into Smith Canal during high water levels in the Delta and San Joaquin River, limiting the level and duration of water saturation and reduce the risk of levee damage or failure. It is anticipated that adequate warning would be provided in order to minimize inconveniences to recreational boat traffic.

New Levee on Duck Creek (Alternative 7a only)

To reduce the risk of flooding, a new levee would be constructed on Duck Creek. This levee would be an extension of the existing French Camp Slough north levee and extend three-fourths of a mile from French Camp Slough to the rail yard. The new levee would be consistent with the measures described in Section 4.3.

RD 17 Area (Alternative 7b only)

Levee Improvements

The RD 17 area includes levee improvements to the French Camp Slough south levee and the San Joaquin River east levee. The measures proposed to improve the levees in the RD 17 area, described in detail in Section 4.3, include cutoff walls, levee height fixes, seepage berms, new levees, erosion protection and slope reshaping. The locations of each fix are shown on Figure 3-9 and summarized in Table 4-4.

New Levees on Oxbow Cutoff and Tie-Back

The work in RD 17 would include construction of two new levees; the oxbow cutoff levee and the southern tie-back levee. The oxbow cutoff levee is proposed for the San Joaquin River east levee at Old River, negating the need to improve a much longer reach of existing levee around the perimeter of the oxbow; however, the existing levee would remain in place. The new levee would be designed as described in Section 4.3 and is shown on Figure 3-9.

The southern tie-back levee would be constructed to extend the existing tie-back levee on the south end of RD 17 to prevent 200-year floodwaters from outflanking the existing levees. The extension would combine with repairs or improvements to the existing tie-in levee to meet current standards. The new levee would be designed consistent as described in Section 4.3 and is shown on Figure 3-9.

4.4.3 ALTERNATIVES 8A AND 8B – NORTH AND CENTRAL STOCKTON, DELTA FRONT, LOWER CALAVERAS RIVER, SAN JOAQUIN RIVER, STOCKTON DIVERTING CANAL LEVEE IMPROVEMENTS, AND RD 17 LEVEE IMPROVEMENTS (ALTERNATIVE 8B ONLY)

Alternatives 8a and 8b would include the same levee improvements as Alternatives 7a and 7b, respectively and would also include additional improvements along the Lower Calaveras River and Stockton Diverting Canal. As is the case for each of the action alternatives, the Calaveras River improvements are addressed within Central Stockton in Chapter 5. The location of each fix for Alternative 8a is shown in Figure 3-10. For Alternative 8b, the location of each fix is shown in Figure 3-11. Tables 4-2 through 4-4 summarize the measures for Alternatives 8a and 8b.

North Stockton Area

Levee Improvements

Improvements for Alternatives 8a and 8b would be the same as for 7a and 7b, respectively.

Fourteenmile Slough Closure Structure

The closure structure and related floodwall for Alternatives 8a and 8b would be the same as for 7a and 7b, respectively.

Central Stockton Area

Levee Improvements

The levee improvements for Alternatives 8a and 8b would include the same measures as for 7a and 7b, respectively. In addition, cutoff walls would be installed along another reach of the Lower Calaveras River, and along the Stockton Diverting Canal to the Old Mormon Slough, as shown on Figures 3-10 and 3-11. Installation of cutoff walls would be consistent with Section 4.3.

Smith Canal Closure Structure and Floodwall on Dad's Point

The closure structure and related floodwall for Alternatives 8a and 8b would be the same as for 7a and 7b, respectively.

New Levee on Duck Creek (Alternative 8a only)

The new levee for Alternative 8a would be the same as for 7a.

RD 17 Area (Alternative 8b only)

Levee Improvements

Improvements for Alternative 8b would be the same as for 7b.

New Levees

New levees for Alternative 8b would be the same as for 7b.

4.4.4 ALTERNATIVES 9A AND 9B – NORTH AND CENTRAL STOCKTON, DELTA FRONT, LOWER CALAVERAS RIVER, SAN JOAQUIN RIVER LEVEE IMPROVEMENTS, MORMON CHANNEL BYPASS AND RD 17 LEVEE IMPROVEMENTS (RD 17 ONLY)

Alternatives 9a and 9b would include the same levee improvements as 7a and 7b, respectively, and would also include construction of a flood bypass and diversion structure in Old Mormon as shown in Figure 4-6. Tables 4-2 through 4-4 summarize the measures for Alternatives 9a and 9b.

North Stockton Area

Levee Improvements

Improvements for Alternatives 9a and 9b would be the same as for 7a and 7b, respectively.

Closure Structure on Fourteenmile Slough

The closure structure for Alternatives 9a and 9b would be the same as for 7a and 7b, respectively.

Central Stockton Area

Levee Improvements

Improvements for Alternatives 9a and 9b would be the same as for 7a and 7b, respectively.

Closure Structure on Smith Canal and Floodwall on Dad's Point

The closure structure for Alternatives 9a and 9b would be the same as for 7a and 7b, respectively.

New Levee on Duck Creek (Alternative 9a only)

The new levee for Alternative 9a would be the same as for 7a.

Mormon Channel Flood Bypass

Alternatives 9a and 9b would include construction of a diversion structure and improvement to the Old Mormon Slough to function as a flood bypass, allowing 1,200 cfs of flood flows to be diverted to the Stockton Diverting Canal. The control structure and channel improvements are described in Section 4.3.

Mormon Slough's course extends in a general southwesterly direction from Bellota to the Stockton Diverting Canal flow diversion structure. The structure diverts all flood flows to the diverting canal, which discharges into the Calaveras River. The Mormon Slough below the diverting dam is referred to locally as Old Mormon Slough or Mormon Channel. The source of flow in Old Mormon Slough is the local tributary area downstream of the diversion structure.

Before construction of the Stockton Diverting Canal, Mormon Channel was connected to Mormon Slough and was perennial in most years. Today, the channel receives local storm water runoff and intermittently contains water.

Reintroducing flood flows to Old Mormon Slough by establishing the Mormon Channel Bypass would involve construction of a diversion structure at the confluence of Old Mormon Slough with the Stockton Diverting Canal and excavation within Mormon Channel to establish the channel as Mormon Slough Bypass. This would likely improve the conditions and health of the remaining vegetation and encourage expansion of the riparian vegetation along much of this channel.

The Mormon Channel Bypass control structure includes a tainter gate that would be operated to divert water into the channel. The gates would likely be operated every 2 years. The amount of water and duration of diverted flows would be adjusted according to the total flows moving through the system. The estimated operation of the structure is shown in Table 4-5.

Table 4-5: Estimated Operations of the Mormon Channel Bypass Control Structure

Frequency Event	Stockton Diverting Channel Flows	Mormon Bypass Flows	Average Length of Operations
50% ACE Event (1/2 year)	3,740 cfs	0 cfs	0 days
20% ACE Event (1/5 year)	8,254 cfs	1,064 cfs	4 days
10% ACE Event (1/10 year)	8,452 cfs	1,200 cfs	5 days
4% ACE Event (1/25 year)	10,720 cfs	1,200 cfs	8 days
2% ACE Event (1/50 year)	11,513 cfs	1,200 cfs	9 days
1% ACE Event (1/100 year)	13,613 cfs	1,200 cfs	11 days
0.5% ACE Event (1/200 year)	14,004 cfs	1,200 cfs	12 days
0.2% ACE Event (1/500 year)	17,236 cfs	1,200 cfs	14 days

RD 17 Area (Alternative 9b only)

Levee Improvements

Improvements for Alternative 9b would be the same as for 7b.

New Levees

The new levees for Alternative 9b would be the same as for 7b.

4.5 CONSTRUCTION DURATION AND CONSTRUCTION FOOTPRINT (INCLUDING STAGING, BORROW AND DISPOSAL)

4.5.1 CONSTRUCTION SCHEDULE

Overall Schedule and Sequencing

For planning purposes, construction is estimated to begin Delta Front levee in 2025 and is expected to last approximately five years, concluding in 2029. This is an estimated schedule, subject to Congressional authorization and appropriation of funds for the project. Construction in North Stockton is estimated to begin in 2027 and last five years, ending in 2031. The Central Stockton area would begin construction in 2030 and last four yers, ending in 2034. Construction of the full project would take 14 years if optimal funding is available.

Annual Work

For Central Stockton, the work averages out to 3 miles of slurry cutoff wall, 0.75 of a mile of geometric improvements and a 0.5 mile of new levee construction per year. During the 3 year span, a closure gate would be constructed for Smith Canal, but would likely be accomplished mainly over 2 summers. For North Stockton, the work averages out to 1.25 miles of slurry cutoff wall, 0.5 mile of geometric improvements, three-eighths of a mile of seismic remediation and three-fifths of a mile of rock revetment per year.

Construction Pace. For work of this type, the expected pace of construction is generally estimated to be:

- A levee 10-feet high and one mile long can be raised 1-foot in 3.5 days, not including mobilization and demobilization. A similar section of levee can be raised 2-feet in 7 days.
- A levee 18-feet high and one mile long can be raised 1-foot in 5.5 days, not including mobilization and demobilization. A similar section of levee can be raised 2-feet in 11.5 days.

Construction Timing. Construction would conform to all applicable State and Federal laws and would generally occur on the San Joaquin River from the middle of July through the end of October. For other rivers, streams and sloughs, construction would occur from the middle of April through the end of October.

Construction Intensity. Existing levee work is considered low to moderately intensive. New levee work and vibratory equipment for sheet pile are likely classified as moderately intense. Impact hammer use for sheet pile work would be considered high intensity. USACE may issue construction specifications requiring vibration monitoring associated with the use of impact hammers.

4.5.2 TEMPORARY AND PERMANENT EASEMENTS

For each action alternative, Table 4-6 shows the construction footprint, O&M easements and the construction duration required, including the footprint of the existing levee plus the waterside and landside easements. The easements identified in Table 4-6 are permanent easements that would be used during construction and maintained permanently for O&M, including vegetation management within the VFZs (15 feet waterside and the appropriate 10 to 20 foot easement landside of the levee toe).

Table 4-6: Construction and Easement Footprints (Structural Features), Construction and O&M Easements and Construction Duration

	Alternatives					
Construction	**7a**	**7b**	**8a**	**8b**	**9a**	**9b**
Construction footprint (ac)	158	367	219	428	190	402
Waterside 15-foot easement (ac)	42	76	62	95	42	76
Landside 20-foot easement[1] (ac)	56	101	82	126	56	101
New levee easement (ac)	4	38	4	38	4	38
Construction duration (years)	14	15	12	15	12	15

[1] Note that the minimum landside easement for existing Federally-authorized levees is 10 feet.

Construction Easements

Access to the levee toe would be provided in all areas where construction is occurring on the levees. Either a 10 foot (minimum) or a 15 foot (maximum) landside access easement would be provided wherever levee remediation is completed as a result of this project.

Calaveras and Mosher Slough. Levee strengthening along portions of lower Calaveras and Mosher Slough would likely not be able to seek sufficient additional Temporary Work Area Easements (TWAE) due to land constraints from existing development. Much of the work would require that mobilizations and stockpiling occur at offsite temporary staging areas that are yet unknown.

Obtaining a Temporary Work Area Easement (TWAE) would likely be sought as the permanent easement is only 10-feet from the landside toe of the levee, which is expected to be insufficient. Depending on the type of construction work, the total easement required during construction could be between 20 and 30 feet. If the project is authorized and funded by Congress, additional design work during PED would clarify easement requirements. Permanent easements would be necessary for areas where a levee raise is planned due to the effect of pushing the landside toe out when requiring proper geometric shaping.

O&M Easements

For levees that are currently part of the Federally authorized FRM project, a minimum permanent landside toe clear easement of 10 feet is required. For levees that are being brought into the Federally authorized project as a result of the RP, a minimum permanent landside toe clear easement of 15 feet is required. For both new and existing levees in the LSJRFS, a minimum permanent waterside easement of 15 feet is required.

4.5.3 STAGING AREAS

Construction staging and access for equipment and materials would take place within the landside project easements (10 to 20 feet landward of the levee toe) where practical and on publicly owned lands or on offsite areas where the NFS would negotiate the temporary use of private lands for this purpose. For certain reaches on the Lower Calaveras River, where a waterside earthen bench is present, staging could take place on either the landside or waterside of the levees; however, waterside use would be restricted to the approved construction season and mandatory environmental safeguards strictly enforced. The actual size, quantity and location of these temporary sites are dependent upon the extent of the construction project phase. For the purposes of evaluating impacts, it was estimated that 1 acre of staging area would be required for every mile of levee construction. The maximum area needed for Alternatives 7a, 8a and 9a would be 33 acres. The maximum area needed for Alternatives 7b, 8b and 9b would be 36 acres. In addition to equipment, materials that may be in the staging areas include soil, rock and slurry batch plants.

Staging areas for construction of the closure structures on Fourteenmile Slough and Smith Canal would be adjacent to the levees on either side of the closure structures. Portions of the Buckley Cove, Louis Park and Dos Reis Park parking lots could be used for staging, potentially affecting normal use of boat ramps and disrupting passive recreational opportunities during the construction season(s).

4.5.4 BORROW MATERIAL AND SITES

A maximum of 1.8 million cubic yards (cy) of borrow material could be required to construct the entire project. The RP, Alternative 7a, would require a maximum of 1.4 million cy of borrow material and could require 138 acres of borrow lands. Table 4-6 shows the anticipated amount of borrow material required to construct each alternative. Because this project is in the preliminary stages of design, detailed studies of each alternative's borrow needs have not been completed. For purposes of NEPA/CEQA, these material estimates will be used to evaluate effects on resources. Actual volumes to be exported from any single site

would be adjusted to match final demands for fill. If the project is authorized and funded, detailed evaluation of borrow requirements, identification and detailed technical evaluation of potential sources, would be completed during PED, including appropriate literature review, site visits, informal consultation with resource agencies and surveys to determine the presence or potential presence of Federally-listed species or their designated critical habitat. Potential sites with listed species occurrences or with the potential for occurrences would be avoided.

Sufficient quantities of appropriate borrow materials are available within 25 miles of the project. To the extent feasible, material would be obtained from a licensed, permitted facility that meets all Federal and State standards and requirements. In addition, many acres of farmland and vacant land exist near the project and borrow could be obtained from these lands. Lands closest to the construction sites would be evaluated for availability and suitability before evaluating lands further from the project. Additionally, site selection would be based on the least environmentally damaging options, the ability to remove and transport the material and economic feasibility. It is assumed that material would be obtained from willing sellers.

The excavation limits on the sites would be in accordance with local regulations and provide a minimum buffer of 50 feet from the edge of the borrow site boundary. From this setback, the excavated slope from existing grade down to the bottom of the excavation would be no steeper than 3H:1V. Excavation depths from the sites would be determined based on need, available suitable material and local groundwater conditions. The sites would be stripped of topsoil material and excavated. Once material is extracted, topsoil would be replaced and sites would be returned to their pre-project or proposed condition when possible and in accordance with the necessary Reclamation Plan.

Any borrow activities would be subject to the Surface Mining and Reclamation Act (SMARA) of 1975 (Public Resources Code, Sections 2710-2796). The SMARA requirements apply to anyone, including State government agencies, engaged in surface mining operations in California (including those on Federally managed lands) that disturb more than 1 acre or remove more than 1,000 cy of material. This includes, but is not limited to, prospecting and exploratory activities, dredging and quarrying, streambed skimming, borrow pitting and the stockpiling of mined materials. At the time the borrow sites are identified, a detailed Reclamation Plan would be developed and appropriate financial assurances would be provided to ensure that each borrow area greater than 1 acre would be restored in a timely manner. SMARA permitting for borrow sites would be at the discretion of the State Mining and Geology Board (SMGB) and would require future CEQA documentation, with the SMGB as CEQA Lead Agency.

Table 4-7: Estimated Borrow Material and Lands Required for Each Alternative

	Alternatives					
Borrow	**7a**	**7b**	**8a**	**8b**	**9a**	**9b**
Amount of borrow material needed (cy)	1,406,000	3,869,000	1,807,000	4,270,000	1,406,000	3,869,000
Estimated borrow lands needed (acre)	138	394	266	450	138	394

4.5.5 DISPOSAL MATERIALS AND SITES

Construction of the closure structures on Fourteenmile Slough and Smith Canal would require dredging and removal of less than 1,000 cy of material from the project site. Some of these materials would be used to construct other project features. The remaining removed material would be hauled offsite and disposed of at an approved site in the vicinity of the project.

Suitable materials removed from the levees would temporarily be placed adjacent to the levee landside and returned to the levee as the remediation is completed. Alternately, materials would be moved to another levee segment for use in constructing that segment. Materials unsuitable for reuse would be removed to commercial and local disposal sites.

4.5.6 POST-CONSTRUCTION OPERATION AND MAINTENANCE

Once project construction is complete, it would be turned over to the CVFPB with an updated O&M manual in accordance with the executed Project Partnership Agreement (PPA) for construction. The PPA is signed before construction begins. Following construction, the NFS would be responsible for continued O&M of the project consistent with the new and/or amended O&M manuals, also referred to as Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Manuals, which specify requirements for operating and maintaining the project.

Levees

Levees should be maintained to the as-built condition in perpetuity or as long as the PPA is in effect. This means that the levee should maintain a consistent shape, side slopes, height and composition to when the levee is constructed. If the levee settles to a lower height or the slopes of the levee cause a loss or material and steepened slopes, the NFS is expected to return the levee to the as-built lines and grade. If the levee erodes due to water moving across the face or wind and wave run-up, the levee should be restored to the as-built condition and the slope protected against future erosion with stone riprap or other means. Holes or burrows into the levee caused by animals should be properly backfilled and measures taken to exterminate burrowing animals. The vegetation on the levee should be maintained as proposed in Section 3.3. The grasses on the slopes and easement area should be maintained to 12" in height or less, unless covered by an approved variance, to allow visibility and accessibility of the levee slope and toes.

Access roads to and along the levee as well as the levee crown should be maintained to the as-built condition ensuring that the crown is sloped to drain and the access roads are sloped to prevent ponding, allowing all-weather access. The NFS will be responsible for making sure encroachments do not occur within the right of way of the project that might endanger efficient functioning of the levee. Lastly, the cutoff walls, jet grouting and seismic remediation measures will be installed within the levee section and sometimes deep into the levee foundation. These features will not be visible from the ground surface following construction. O&M of these features are to ensure that they remain in place and are not penetrated by encroachments or other ground disturbing activities.

Floodwalls

Floodwall maintenance is very similar to the concept of levee maintenance: keep the floodwall in the as-built condition in perpetuity or as long as the project partnership agreement is in effect. The NFS should ensure that the floodwall does not settle or shift from its constructed position, which could impact the effective height of the wall or the wall's water tight seals. If the concrete cracks, spalls or has exposed rebar, the wall should be patched or repaired. The vegetation along the wall should be maintained within the project easements to ensure visibility and accessibility to the wall. Erosion near the floodwall and floodwall foundation could threaten the stability and should be repaired. The eroded area should be restored to the as-built condition and the area protected against future erosion. Lastly, drainage features for the wall should be inspected and properly maintained, including any pipes through the levee and drainage features for the wall itself.

Closure Structures

Overview. Two closure structures would be constructed as part of each of the final alternatives, including the RP. One would be located on Fourteenmile Slough and one would be on Smith Canal. The gates would be open except during routine maintenance, when the Delta exceeds a flood stage of 8 feet NAVD88, or a levee breach has occurred within the slough reach. For reference, the 100-year elevation is 10.1 ft NAVD88 and the 200-year elevation is 12.1 ft NAVD88.

Normal Operation. The gate would be closed when the delta stage is at 8.0 feet NAVD88 and rising and would be opened when the delta stage was 8.0 feet NAVD88 and falling. The gate would also be opened if the stage on the slough side of the gate rose higher than the delta stage. This would allow accumulated interior drainage behind the gate to flow out.

Emergency Operation. One or both gates could be closed indefinitely in case of a levee failure occurred along Smith Canal or Fourteenmile Slough. The gate would be reopened once the levee repairs were made.

Maintenance. Maintenance requirements would include exercising each gate briefly (closed and immediately opened) once or twice a year for O&M purposes. All routine maintenance of the motors, gears, etc. for the gate can be accomplished from above while the gate is in the open position. For major maintenance, the gates can be removed with a barge mounted crane and inspected, repaired and/or replaced. This would eliminate the need to place stop logs across the opening for routine maintenance.

Frequency and Duration of Operations. An analysis of hypothetical gate operations was conducted for 2010 and 2070 sea level conditions using 32 water years (1983 to 2014) of recorded daily minimum, mean, and maximum tide stages. Delta stages are the result of ocean tide conditions in combination with runoff from the Sacramento and San Joaquin River systems. The historical record is a good indicator of the potential operations because it includes the historical combination of tides and flow. The analysis compared historical stages to the proposed operating criteria and is summarized in Table 4-8.

Table 4-8: Total hours per month gate would have been closed assuming 2010 Sea Level Conditions. 1983 to 2014

Water Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1983	0	5	8	46	17	59	0	0	0	0	0	0
1984	0	0	11	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	2	0	0	0	0	0	0
1987-1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	3	0	11	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	1	99	6	0	0	0	0	0	0	0
1998	0	0	0	0	95	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	2	0	0	0	0	0	0	0
2001-2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	2	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	1	0	0	0	0	0	0	0	0
2006	0	0	7	16	0	0	1	0	0	0	0	0
2007-2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	1	0	0	0	0	0	0
2012-2014	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	0	5	11	99	95	59	1	0	0	0	0	0
Mean	0	0	1	5	4	2	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0

4.6 ESTABLISHMENT OF ETL COMPLIANT LEVEES

4.6.1 USACE "GUIDELINES FOR LANDSCAPE PLANTING AND VEGETATION MANAGEMENT AT LEVEES, FLOODWALLS, EMBANKMENT DAMS AND APPURTENANT STRUCTURES," (ETL 1110-2-583)

The USACE "Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams and Appurtenant Structures," (ETL 1110-2-583) dated 30 April 2014, provides the standards for vegetation on and adjacent to USACE facilities. To be compliant, levees, floodwalls and 15 feet landward and waterward of the levee toes or floodwall face, must be maintained free of woody vegetation unless a variance is granted by USACE.

Variance

A variance to the ETL may be considered after in-depth engineering analyses have been completed that demonstrate that the levees and/or floodwalls are not imperiled by maintaining woody vegetation on or within 15 feet of the levee or floodwall.

4.6.2 THE RECOMMENDED PLAN

Structural FRM Features

In order to construct the structural FRM features of the RP, vegetation would need to be removed from the upper half of the levee. This would also be required for construction of the other alternatives. Constructing some features, like slope reshaping or height repairs, will also require removal of all vegetation from the landside levee face and landside easement. Constructing the two closure structures (one each on Fourteenmile Slough and Smith Canal) and the floodwall on Dad's Point (at Smith Canal) would require removal of waterside vegetation from the waterside levee toe and waterside easement or from the bank.

ETL Compliance

During the construction phase, the levees included in the RP would be brought into compliance with the USACE ETL 1110-2-583, either through removal of vegetation or by obtaining a variance. The levees will undergo intensive engineering evaluation during PED to determine their suitability for a variance. This would be required for any of the alternatives. Based upon the information available at this time and using engineering judgment, it is estimated that 50% of the existing vegetation on the lower waterside slope and within the waterside easement may be allowed to remain; almost none of the vegetation on the landside levee slope or within the landside easement would be allowed to remain.

Variance Evaluation Process

During PED, all levee reaches will be evaluated for a vegetation variance using data that is not currently available in feasibility. This risk-based process involves: determining what species of trees are present in the proposed variance zone; determining the maximum size that trees would grow to; analyzing the root ball size that would be expected for mature trees, which would be used to identify the size of a hole left if the tree falls during a flood event; analyzing the amount of additional scour that could occur in a flood event; seepage and stability analyses accounting for any newly constructed features; and development of cross-sections illustrating the trees, root systems and levee prism. Trees that would likely be identified for removal include dead trees and nut trees. Nut trees may attract burrowing rodents, which may become a levee safety concern.

CHAPTER 5 — AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment and environmental consequences of each of the alternatives in the final array, mitigation measures for potential impacts, cumulative effects and other environmental considerations for implementing the LSJR project.

NEPA and CEQA require that the environmental effects of a project be analyzed for significance. Under NEPA, impacts are considered significant because of their context (location sensitivity) and intensity (magnitude of impact) (40 Code of Federal Regulations [CFR] Section 1508.27). Under CEQA, impacts are assessed based on specific significance criteria consistent with State CEQA Guidelines Appendix G (14 California Code of Regulations 15000 et seq.). For the purposes of CEQA, potential effects are determined by assessing the potential impacts of the proposed action on the existing conditions for each resource. For the purposes of NEPA, potential project effects are assessed in relation to the conditions described in the No Action Alternative. For this impact analysis, effects are evaluated against existing conditions since these conditions either reasonably represent future conditions in the project area or because existing conditions will facilitate full evaluation and disclosure of the greatest potential impacts of the proposed project.

The CEQA baseline environmental conditions assumed in the preparation of this chapter consist of the existing environment as of January 15, 2010, when USACE published the NOI to prepare an EIS in the *Federal Register* and SJAFCA published the NOP to prepare an EIR with the State Clearinghouse (State Clearinghouse Number (SCH#) 2010012027). Resource conditions were reassessed and updated between Fall 2013 and Spring 2014. Changes in the existing conditions during that time were not substantial.

The alternatives evaluated in this chapter are described in Chapter 4. They are:

Alternative 1 – No Action

Alternative 7a – North and Central Stockton – Delta Front, Lower Calaveras River and San Joaquin River (SJR) Levee Improvements excluding RD 17

Alternative 7b – North and Central Stockton – Delta Front, Lower Calaveras River and SJR Levee Improvements including RD 17

Alternative 8a – North and Central Stockton – Delta Front, Lower Calaveras River, SJR and Stockton Diverting Canal Levee Improvements excluding RD 17

Alternative 8b – North and Central Stockton – Delta Front, Lower Calaveras River, SJR and Stockton Diverting Canal Levee Improvements including RD 17

Alternative 9a – North and Central Stockton – Delta Front, Lower Calaveras River, SJR Levee Improvements and Mormon Channel Bypass excluding RD 17

Alternative 9b - North and Central Stockton – Delta Front, Lower Calaveras River, SJR Levee Improvements and Mormon Channel Bypass including RD 17

This chapter meets NEPA requirements for determination of the overall impact of each alternative and also CEQA requirements for an impact-by-impact determination of effect. The terms *environmental consequences*, *environmental impacts* and *environmental effects* are synonymous in this analysis.

The structure of each section is as follows:

Environmental Setting

- **Regulatory Framework.** This section lists the laws, regulations and policies that are considered in the assessment of effects on the resource and are more fully described in Chapter 7, Compliance with Applicable Laws, Policies and Plans.
- **Existing Conditions.** This section describes the environmental setting and considers environmental conditions in the area at the time that the NOP and NOI were published. Resource conditions were reassessed and updated between Fall 2013 and Spring 2014.

Environmental Consequences

- **Assessment Methods.** This section describes methods, models, process and procedures, data sources and/or assumptions used to conduct the effect analysis. Where possible, effects are evaluated quantitatively. Where quantification is not possible, effects are evaluated qualitatively.
- **Basis of Significance.** This section provides the criteria used to define the level at which an effect would be considered significant. Significance criteria (sometimes called thresholds of significance) in this FR/EIS/EIR are based on the checklist presented in Appendix G of the State CEQA Guidelines; factual or scientific information and data; and regulatory standards of Federal, state and local agencies. Under NEPA, preparation of an EIS is triggered if a Federal action has the potential to "significantly affect the quality of the human environment." The significance thresholds used in this FR/EIS/EIR also encompass factors taken into account under NEPA to evaluate the context and intensity of the effects of an action.
- **Effects and Mitigation Measures.** To comply with NEPA and CEQA, the effects are considered and evaluated as to whether they are direct, indirect or cumulative (40 CFR Section 1508.8). Direct effects are caused by the action and occur at the same time and place. Indirect effects are reasonably foreseeable consequences to the physical environmental that may occur at a later time or at a distance from the project area. Cumulative effects for all resource areas are discussed in Section 5.23, "Cumulative Effects." Measures to mitigate (i.e., avoid, minimize, rectify, reduce or compensate for) accompany each effect discussion. There are 2 significant differences related to mitigation between NEPA and CEQA:
    1) CEQA requires any feasible mitigation measures that could minimize significant impacts be described, while NEPA does not (as long as the agency justifies its decision not to adopt feasible measures); and
    2) CEQA mitigation requirements apply only to adverse environmental impacts found to be significant, while NEPA's regulations apply to any adverse impacts, even if not significant.

Each effect is accompanied by a finding or conclusion, as required. Table 5-1 provides a key for relating the effect findings by relative severity (increasing degree of adversity to the environment).

Table 5-1: Key to Effect Findings (by Increasing Adversity)

Beneficial
No Effect
Less Than Significant
Too Speculative for Meaningful Consideration
Significant
Significant and Unavoidable

For the purposes of the analyses, the effect findings are defined:

- **Beneficial.** Would provide benefit to the environment as defined for that resource.
- **No Effect.** Would cause no discernible change in the environment as measured by applicable significance criterion; therefore, no mitigation would be required.
- **Less Than Significant.** Would cause no substantial adverse change in the environment as measured by applicable significance criterion; therefore, no mitigation would be required under CEQA, but there may be mitigation per other environmental regulations.
- **Significant.** Would cause a substantial adverse change in the physical conditions of the environment. Effects based on the significance criteria fall into 2 categories: those for which there is feasible mitigation available that would avoid or reduce the environmental effects to less than significant levels and those for which either there is no feasible mitigation available or for which, even with implementation of feasible mitigation measures, there would remain a significant adverse effect on the environment. Effects that cannot be reduced to a less than significant level by mitigation are identified as significant and unavoidable, as described below.
- **Significant and Unavoidable.** This effect would cause a substantial adverse change in the environment that cannot be avoided or mitigated to a less than significant level if the project is implemented. Even if the effect finding still is considered significant with the application of mitigation, the lead agencies are obligated to consider all feasible measures to reduce the severity of the effect. Under CEQA, a Statement of Overriding Considerations must be adopted if a proposed project results in one or more significant unavoidable impacts. NEPA has no similar "overriding considerations" requirement.
- **Too Speculative for Meaningful Consideration**. An impact may have a level of significance that is too uncertain to be reasonably determined and would therefore be considered too speculative for meaningful consideration in accordance with State CEQA Guidelines CCR Section 15145. After thorough investigation, the determination of significance may still be considered too speculative to be meaningful. This is an effect for which the degree of significance cannot be determined for specific reasons, such as unpredictability of the occurrence or the severity of the impact, lack of methodology to evaluate the impact or lack of an applicable significance threshold. However, when a determination of significance is uncertain, it is still assumed to be "significant," as described above.

During the PED phase of the project, if authorized, USACE would then do a site-specific analysis including full biological site surveys and site-specific engineering. USACE shall prepare supplements to either draft or final EISs if: (i) USACE makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

5.1 GEOLOGY AND GEOMORPHOLOGY

This section describes the affected environment and environmental consequences relating to geology and geomorphology for the LSJR project. The significance of impacts and mitigation measures to reduce impacts are also discussed.

5.1.1 ENVIRONMENTAL SETTING

Regulatory Framework

Federal

- Clean Water Act (CWA) Section 402

State

- California Building Standards Code
- California Code of Regulations: Title 23, Division 1, Article 8, Sections 111–137
- California SMARA of 1975
- National Pollutant Discharge Elimination System (NPDES) Permit

Regional and Local

- City of Lathrop General Plan 1991
- City of Stockton General Plan (2007)
- San Joaquin County General Plan 2010
- City of Manteca General Plan 2023

Existing Conditions

Regional Geology

The project area lies within the San Joaquin Valley portion of the Great Valley Geomorphic Province of California. This geomorphic province is between the north Coast Ranges to the west and the Sierra Nevada to the east and was a depositional basin throughout most of the late Mesozoic and Cenozoic periods. Vast accumulations of sediments deposited during cyclic transgressions and regressions of the shallow sea that once inundated the valley.

As a result, a thick sequence of sedimentary rocks form the bedrock deeply buried in the mid-basin areas of the valley. These rocks are derived from erosion of the adjoining highlands from the Late Jurassic to the Pleistocene periods and from Tertiary volcanic. Late Pleistocene and Holocene (Recent) alluvial deposits cover the area. These consist of reworked fan and stream materials deposited prior to the construction of the existing FRM infrastructure.

The flow of the SJR formed the SJR Valley between the Stockton Arch to the north and the Tehachapi Mountains to the south. The Stockton Arch is a geologic feature (up-warping of crust underneath sediments) underlying the Central Valley in the Delta near Stockton and is considered the subsurface separation between the Sacramento River basin and the SJR basin.

The existing levee system is located on deposits consisting of Holocene alluvium and Holocene basin deposits, as well as late Pleistocene alluvial fan and terrace deposits of the Modesto and Riverbank Formations. These Quaternary deposits are variably dissected and overlain by younger Quaternary (Historical) deposits consisting of channel, floodplain and artificial fill (levees and spoils from dredging).

Local Geomorphology

DWR contracted with URS Corporation to conduct geotechnical and geomorphic evaluations of both urban (Urban Levee Evaluation (ULE)) and non-urban (Non-Urban Levee Evaluation (NULE)) levees in the

Sacramento and SJR basins (URS Corporation, 2014). The ULE program included those levees designated as "Urban Project" and "Urban Non-Project" in the project area except for the upper Calaveras River and levees near Brookside and Rough and Ready Island. The NULE program included the "Non-Urban Project" levees on the SJR from the Burns Cutoff south to the Stanislaus River.

The existing geomorphic conditions in the project area include three general geologic domains with relatively consistent geologic deposits. From west to east, these domains are the intertidal, alluvial fan and piedmont. Each domain is divided locally by historic channels, overbank deposits and/or other surface conditions. The intertidal domain (Delta Front) is near present-day sea level and described as consisting of sandy and silty alluvial deposits buried by organic-rich, fine-grained wetland deposits. Subsurface deposits within the intertidal domain are most likely highly variable, laterally as well as vertically. The piedmont domain (foothills) generally consist of relatively old, consolidated and cemented sediments of the middle to late Pleistocene.

The alluvial fan domain (valley floor) comprises most of the project area and generally consists of late Pleistocene deposits (the Modesto Formation) underlain by the Riverbank Formation. Subsurface deposits of sand, silt and clay are most likely highly variable, laterally as well as vertically. Two different geometries were identified within the alluvial fan domain: one in which the levee trends oblique to the mapped abandoned channels (west part of the domain) and the other in which the levee trends parallel to the mapped abandoned channels (east portion of the domain).

The SJR, lower Calaveras River and other streams in the project area are alluvial rivers in which the bed and banks are made up of mobile sediment and/or soil. Alluvial rivers are self-formed, meaning that their channels are shaped by the magnitude and frequency of the floods that they experience and the ability of these floods to erode, deposit and transport sediment. However, construction of levees and placement of bank protection such as riprap in the past have altered these natural processes, including channel migration (river meandering) along these rivers.

5.1.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

The types and extent of potential effects and significance were assessed by reviewing geologic and geomorphic maps, reviewing geotechnical and geomorphic studies, discussing geotechnical aspects with professional staff and then considering the work proposed under each alternative.

Basis of Significance

- Substantially alter regional geologic resources or processes;
- Substantially alter local geomorphologic conditions or processes; or
- Substantially alter natural river meandering, bank erosion and deposition.

5.1.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, no construction activities would occur and the geologic resources and processes would be expected to remain the same because of the regional nature and extent of the resource. While regional geomorphologic conditions and processes would also remain the same, the local geomorphic conditions on the alluvial fan would be influenced by past FRM and future development. Construction of levees, berms and bridges is assumed to continue to affect the patterns of sediment erosion and deposition on the valley floor fan. Changes in erosion and/or deposition could affect the structure and functioning of existing levees, leading to increased risk of levee failure and flooding.

The magnitude of the impact of flooding resulting from levee failure would depend on the location of the levee breach, severity of the storm and river flows at the time of flooding. In the event of a flood, levee failures could result in soil scouring and erosion in localized areas within several hundred feet of a levee breach, altering local geomorphologic processes. The location and extent of damage and impacts related to soil erosion could be minor to extensive. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.1.4 ALTERNATIVES 7A, 7B, 8A, 8B, 9A AND 9B

These alternatives would have no effect on the geology or regional geologic resources or processes, because of the nature of the proposed levee work and the regional extent of the resources. The work would be limited to borrow site activities and improvements along levees within a relatively small project area as compared with the geologic and regional geomorphologic conditions in the broader San Joaquin Valley and adjacent foothills.

However, the alternatives could have short and long-term effects on the local geomorphology in the project area. Short-term effects during construction involving the bank and/or water side of the levees (Chapter 4, Description of Final Alternatives) would result in substantial soil disturbance and could include temporary disruptions in patterns of bank erosion and downstream deposits of sediments on the valley floor caused by wind or early-season rainfall events. The disruption may increase depending on the extent, type, and amount of work proposed under each alternative; e.g., 7a would result in the least disruption while 9b would result in the most disruption.

The construction contractor shall be required to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) and comply with the conditions of the NPDES general stormwater construction activity permit. Potential erosion during construction would be addressed through the implementation of BMPs. Potential erosion concerns and the associated BMPs are addressed in Water Quality, Section 5.5. In addition, Alternatives 9a and 9b, would result in the introduction of floodflows to Old Mormon Slough that could routinely mobilize some sediment and transport it downstream into the Stockton Deepwater Ship Channel. The flood bypass would be designed to minimize these erosion and deposition processes to **less-than-significant** levels.

Consistent with project objectives, the completed project would provide long-term FRM benefits by improving the structure and functioning of the existing levee system. As such, the levees would continue to affect local geomorphologic processes similar to those under the No Action Alternative. As a result, there would be no significant long-term effects on geology or geomorphology and the project would result in less than significant impacts. Additionally, the completed project would not further alter the natural river meandering or deposition and is designed to prevent bank erosion; therefore, would result in **less than significant** impacts.

5.1.5 MITIGATION

There would be no significant effects on geology or geomorphology; therefore, no mitigation is required.

5.2 SEISMICITY

This section describes the affected environment and environmental consequences relating to seismicity for the LSJR project as well as the significance of the impacts and mitigation measures to reduce impacts.

5.2.1 ENVIRONMENTAL SETTING

Regulatory Framework

Federal

- Federal Earthquake Hazards Reduction Act

State

- Alquist-Priolo Earthquake Fault Zoning Act
- California Building Standards Code
- California Code of Regulations: Title 23, Division 1, Article 8, Sections 111–137
- California Seismic Hazards Mapping Act

Regional and Local

- City of Lathrop General Plan 1991
- City of Stockton General Plan 2007
- San Joaquin County General Plan 2010
- City of Manteca General Plan 2023

Existing Conditions

Faults and Seismic Activity

The west side of the Central Valley is a seismically active region. Many faults exist in the San Francisco Bay Area and numerous earthquakes of magnitude (M) 5.0 or greater have occurred on regional faults, primarily those of the San Andreas Fault system. Significant earthquakes are generally associated with crustal movements along well-defined active fault zones. The last major earthquake on the San Andreas Fault was the Loma Prieta earthquake in October 1989 with a magnitude of 6.9, approximately 71.2 miles from Stockton. Other large earthquakes that have occurred within the region were the Milpitas earthquake (5.6 M) in October 2007 on the Calaveras Fault, 44.2 miles from Stockton and the American Canyon earthquake (6.0 M) in August 2014 on the West Napa Fault, 58.2 miles from Stockton.

No active faults have been mapped within project area by the USGS or California Geological Survey (Jennings, 1994) and the project area is not located in an Alquist-Priolo Earthquake Fault Zone (California Geological Survey, 2007). The Stockton Fault (or Stockton Arch) traverses in a northeast to southwest direction, parallel to Highway 4, North of RD 17. However, the Stockton Fault has not been active in the last 1.6 million years. The Vernalis, San Joaquin and Black Butte Faults are located near Tracy, CA, 2.5 miles, 11 miles and 12.5 miles west of the project area, respectively. However, these faults have not been active in the last 11,000 to 1.6 million years. As a result, ground rupture in the project area is of a low risk as compared to other areas in the San Joaquin Valley.

The U.S. Geological Survey (2005) estimated the probabilities of a magnitude 6.7 or greater earthquake occurring at the faults located in the study vicinity before 2032: Hayward Fault (27 percent), San Andreas Fault (21 percent), Greenville Fault (3 percent) and Concord-Green Valley Fault (4 percent). Moreover, using newly collected and updated theories of earthquake activity, the USGS concluded that there is a 62 percent chance of at least one magnitude 6.7 or greater quake striking somewhere in the San Francisco Bay region before 2032 (USGS, 2005).

Potential seismic hazards from a nearby moderate to major earthquake are generally classified as primary and secondary. The primary effect is fault ground rupture, also called surface faulting. Because there are no active faults in the project area and the area is not located within an Alquist-Priolo Earthquake Fault Zone, fault ground rupture is negligible. Common secondary seismic hazards include ground shaking, liquefaction, subsidence and seiches.

Active faults were mapped and are classified as A, B or C type faults specifically for use with the California Building Standards Code. Faults are classified based on the magnitude of earthquakes typically associated with them and the fault's slip rate. Type A faults cause the greatest potential destruction; Type C cause the least. Faults in the vicinity of the project area with a moderate to high potential for seismicity include the Hayward, Calaveras, Concord-Green Valley and Greenville Faults. The closest known active faults to the project and the details and project risks associated with them, are listed in Table 5-2.

Table 5-2 Maximum Credible Earthquake Magnitudes

Fault	Estimated Distance from Project Site	Fault Class1	Maximum Credible Earthquake2	Slip Rate (mm/yr)
Greenville Fault Zone, North Section	20 miles	B	6.6	2
Greenville Fault Zone, South Section	24 miles	B	6.6	2
Calaveras Fault – Northern Segment	34 miles	B	6.8	6
Concord- Green Valley	38 miles	B	6.2	5
Hayward Fault – North Segment	45 miles	A	6.4	9

Notes:
1. Faults with an "A" classification are capable of producing large magnitude (M) events (M greater than 7.0), have a high rate of seismic activity (e.g., slip rates greater than 5 millimeters per year) and have well-constrained paleoseismic data (e.g., evidence of displacement within the last 700,000 years). Class B faults are those that lack paleoseismic data necessary to constrain the recurrence intervals of large-scale events. Faults with a "B" classification are capable of producing an event of M 6.5 or greater.
2. The moment magnitude scale is used by seismologists to compare the energy released by earthquakes. Unlike other magnitude scales, it does not saturate at the upper end, meaning that there is no particular value beyond which all earthquakes have about the same magnitude, which makes it a particularly valuable tool for assessing large earthquakes.
Sources: Cao et al., 2003; Jennings 1994; Petersen et al., 1996; data compiled by USACE in 2014

Liquefaction and Settlement

Liquefaction is the liquefying of certain sediments during seismic ground-shaking, resulting in temporary loss of support to overlying sediments and structures. Differential settlement occurs when the layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills. Poorly consolidated, water-saturated fine sands, located within 30 to 50 feet of the surface, typically are considered the most susceptible to liquefaction. Dry soils and sediments consisting of finer grained materials are generally not susceptible to liquefaction.

Many of the levees in the project area are constructed over alluvial deposits and may be susceptible to liquefaction or degradation due to a seismic event. The area is unusual in that it contains infrequently water-

saturated levees in Central and South Stockton, but also frequently saturated levees in North Stockton and Delta Front. Frequently saturated levees are likely to be sensitive to seepage, leading to breach with seismic-event induced transverse cracking or displacement.

USACE conducted liquefaction triggering analyses and identified liquefiable material along several levees in the project area. Static limit equilibrium stability analyses were then conducted for these levees. Based on the analyses, the flood protection ability after a 200-year seismic event was judged to be compromised at several locations. Thus, a large regional earthquake during a major flood event would increase the potential liquefaction, settlement and levee failure. The greatest susceptibility is along the Delta Front and North Stockton. The highest combination of susceptibility and consequences occurs along a one mile stretch of the San Joaquin River immediately downstream of the Calaveras River. This portion of levee experiences about 5 feet of water above the landside levee toe on a daily basis at high tide.

5.2.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

The types and extent of potential effects and significance were assessed by reviewing seismic fault and event maps, reviewing seismic studies, discussing seismic aspects with professional staff and then considering the work proposed under each alternative.

Basis of Significance

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving:
  - Rupture of a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; strong seismic ground shaking;
  - Seismic-related ground failure, including liquefaction; or
  - Landslides.
- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an on-site or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

The project area is not located within or adjacent to an Alquist-Priolo Fault Zone or any known active fault. Therefore, the risk of surface fault rupture is negligible and is not evaluated further. Additionally, the project area is relatively flat and there would be no adverse impacts related to landslides. So, landslides are not addressed further.

5.2.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, no construction activities would occur. The structural integrity of existing levees, berms and bridges would continue to pose a risk for flood damage to the Stockton, Lathrop and Manteca areas from high magnitude seismic events on active faults to the west. Some of the levees in tidally loaded areas would also continue to be at risk from seismically induced structural instability and/or failure due to liquefaction of soils. The magnitude of the impact of flooding resulting from levee failure would depend on the location of the levee breach, severity of the storm and river flows at the time of flooding. One location on the San Joaquin River is at risk of liquefaction, levee failure, and flooding under normal tidal loading. Predicting other events which combine seismic and flood loading and providing a

determination of significance is not possible based on information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.2.4 ALTERNATIVES 7A, 7B, 8A, 8B, 9A AND 9B

These alternatives would have no effects on known seismic faults or cause ground movement along faults, because work would be limited to borrow sites activities and improvements along surface waterways, while seismic forces are subsurface and regional. In addition, there are no identified active faults in the project area.

The proposed project could experience at least one earthquake within the life of the project. Design, construction and maintenance must comply with the regulatory standards of USACE including requirements for seismic design. The design and construction of the cutoff walls, floodwalls and/or levees would meet or exceed applicable design standards for static and dynamic stability, seismic ground shaking, liquefaction, subsidence and seepage, minimizing the potential for significant damage. Therefore, the proposed project would not affect the existing geology and seismicity of the area or expose people or structures to potential risk or injury.

Consistent with project objectives, the completed project would provide long-term FRM benefits by improving the structure and functioning of the existing levee system. This includes designing the proposed features to avoid or minimize any potential for seismic-related ground failure in tidally influenced areas of the project.

The geotechnical investigation prepared for the proposed project did not indicate evidence of instability because of landslides, subsidence or collapse. Liquefaction analysis indicates some existing levees within the project area are constructed over alluvial deposits that could be susceptible to liquefaction or degradation due to a seismic event. Design recommendations to address this condition are provided in the Geotechnical Investigation would be implemented. The proposed project would implement standard grading and soil engineering practices to ensure that foundations are adequately supported and do not settle or otherwise fail. This includes excavating the existing soils and replacing them with compacted engineered fill. In addition, all structures associated with the proposed project would be designed in accordance with USACE standards. Because project facilities would be designed, constructed and maintained in accordance with applicable standards, risk of failure due to a seismic event would be minimized and this impact is **less than significant**.

5.2.5 MITIGATION

There would be no significant effects from seismicity; therefore, no mitigation is required.

5.3 SOILS AND MINERAL RESOURCES

This section describes the affected environment and environmental consequences relating to soils and mineral resources for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed.

5.3.1 ENVIRONMENTAL SETTING

Regulatory Framework

Federal

- CWA Section 402

State

- California Building Standards Code
- California Code of Regulations: Title 23, Division 1, Article 8, Sections 111–137
- California Surface Mining and Reclamation Act of 1975
- NPDES Permit

Regional and Local

- City of Lathrop General Plan 1991
- City of Stockton General Plan 2007
- San Joaquin County General Plan 2010
- City of Manteca General Plan 2023

Existing Conditions

Soil Types and Characteristics

Soils in the San Joaquin Valley resulted from erosion and deposition of rock types in and along the SJR and tributaries in the watershed. According to a NRCS soil survey of San Joaquin County, three general soil map units (Qm, QdB, Qs) are found within the 100-year floodplain of the SJR (NRCS, 2002). General soil map units describe a unique natural landscape generally comprised of 2 or more soil series. A soil series describes soils that have nearly identical profiles and other physical properties.

Soils in the project area range from highly sandy to dominantly fine, with fine to extremely coarse gradations. Erosion and expansion potentials are low to moderate for the soil series. Severe erosion is not generally a concern due to the relatively level terrain; however, wind can erode exposed and recently disturbed soils. Expansive soils contain a higher content of clay and expand and shrink, depending on water content. Subsidence can occur locally as a result of seasonal changes in soil moisture content. Substantial groundwater-related subsidence occurred throughout the San Joaquin Valley as drainage of lowlands resulted in the decomposition of organic components in the soils.

Mineral Resources

In compliance with SMARA, the California Geological Survey established the classification system to denote the location and significance of key extractive resources. Sand and gravel aggregate are the principal mineral resources in San Joaquin County. According to the California Department of Conservation (CDC), Division of Mines and Geology (1988), the majority of the project area is classified as MRZ-1, meaning that no significant mineral deposits are present in this area or that little likelihood exists for their presence. An area between Lathrop and Manteca (Stockton-Lodi Production-Construction Region, Segment D) is classified as MRZ-2, meaning that significant mineral deposits are known to be present or are highly likely to be present and is designated as being of regional significance. The south part of RD 17, in and around

the Cities of Lathrop and Manteca, is classified as MRZ-3, meaning that there is a potential for mineral resources in this area. Just north of Stockton is another small area delineated as MRZ-3.

Lands classified as MRZ-1 or MRZ-3 are not affected by State policies pertaining to the maintenance of access to regionally significant mineral deposits under the California Surface Mining and Reclamation Act of 1975. Lands classified as MRZ-2 are subject to these State policies that support mining operations, including dredging and quarrying and are intended to ensure that mineral resources will be available when their development is necessary or economically feasible (CDC, 2013). However, the MRZ-2 sector between Lathrop and Manteca lies outside the area that would be affected by the alternatives in the LSJRFS.

5.3.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Basis of Significance

- Result in substantial erosion of soil or loss of topsoil;
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property;
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater; or
- Result in the loss of availability of a known mineral resource of economic value to the region and the residents of the State or a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.

The project would not involve the use of wastewater disposal systems of any kind, including septic systems and there would be no impacts. Therefore, this issue is not addressed further in this document.

5.3.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, no construction activities would occur. The soil types and their characteristics on the alluvial fan in San Joaquin County would be expected to remain the same as deposited over time. Water and wind erosion of exposed and recently disturbed soils would continue to weaken the structure of levees along the SJR and tributaries. The risk of levee failure and flooding would also continue, resulting in soil scouring and substantial loss of nearby valuable topsoil in the event of a breach. The eroded soils could be carried by the floodwaters and deposited in developed areas, causing damage to residences, businesses and infrastructure. This would be considered a potentially significant effect. Implementation of USACE levee vegetation management requirements is not expected to occur under the No Action Alternative; therefore, removal of waterside and landside vegetation would not occur.

The magnitude of impacts and flood damage related to soil erosion would depend on the levee breach location, storm severity, flooding duration and river flows. During a flood, levee failures could result in soil scouring, erosion and permanent loss of top soil in localized areas within several hundred feet of a levee breach. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

The principal mineral resources in San Joaquin County are deposits of sand and gravel aggregate and many companies are currently mining and processing these deposits as regulated by the State and County. Mining operations would continue to be at risk of disruption, damage or loss of mineral resources in the event of levee failure and flooding, which could affect the local economy. The substantial soil subsidence in the valley south of Stockton due to over-pumping of groundwater and drainage of lowlands by agricultural and municipal interests would also continue. These would be considered as potentially significant effects.

5.3.4 ALTERNATIVES 7A, 7B, 8A, 8B, 9A AND 9B

These alternatives would have no effect on the soil types or their characteristics on the alluvial fan. However, they would have short-term effects on soils in the project area during construction. These would include disturbing soils at staging areas; clearing, excavating and clearing soils during site preparation; excavating, stockpiling and/or removing soil material at borrow sites; and depositing and shaping soils at the work site. Table 5-3 lists the approximate area of disturbance by alternative. These activities could result in the potential for surface water to carry sediment into the stormwater and local waterways or increase airborne dust, resulting in potential effects on existing water quality and air quality. These short-term effects would increase with the extent, type and amount of work proposed under the alternatives. The potential effects on water quality and air quality of the alternatives, BMPs and mitigation measures are discussed in detail under Sections 5.5 and 5.8, respectively.

Table 5-3: Approximate Area of Disturbance by Alternative

Alternative	Construction Footprint (ac)	Estimated Borrow Area (ac)	Total Footprint (ac)
Alternative 7a	158	138	296
Alternative 7b	367	394	761
Alternative 8a	219	266	485
Alternative 8b	428	450	878
Alternative 9a	190	138	328
Alternative 9b	402	394	796

Under the NPDES permitting program, the preparation and implementation of a SWPPP is required for construction activities that disturb more than 1 acre in size and must identify potential sources of erosion that may be reasonably expected to affect the quality of stormwater discharges, as well as identify and implement BMPs that ensure the reduction of eroded soil during stormwater discharges. The contractor would be responsible for implementing BMPs and ensuring compliance with the requirements of the SWPPP. With erosion control BMPs, SWPPP and USACE oversight in place, impacts related to accelerated erosion during construction and ground-disturbing maintenance are expected to be **less than significant** and no mitigation is required.

The ground-disturbing activities associated with vegetation clearing to meet USACE vegetation management guidance would require vegetation be cleared on levee slopes and 15 feet out from the waterside and landside levee toes, potentially resulting in significant erosion and sedimentation. Although the area subject to disturbance is substantial, significant large-scale erosion and generation of runoff is not anticipated because construction would be reduced or not occur during the winter months because of risks to levees during the flood season. Site specific measures that would control erosion would be described in more detail in the SWPPP, which is a requirement of the NPDES General Permit (Section 5.5 WATER QUALITY). The specific BMPs to be implemented would be determined prior to issuance of the NPDES General Permit, in coordination with the RWQCB and would substantially reduce or prevent erosion and sediment-related effects. So, this impact is considered **less than significant** and no mitigation is required.

Once construction is complete, all disturbed areas would be reseeded to encourage revegetation and minimize erosion. As a result, the short-term effects on local soils would likely be **less than significant**. Once the project is complete, the type and frequency of maintenance activities would be expected to remain the same. As a result, the project would not be expected to have long-term effects on soils.

Soils in the project area have not been identified as compressible or unstable. Their expansion potential is not known at this time. However, construction of all project elements would be supported by a site-specific geotechnical investigation, which would include an evaluation of site soils and recommendations to ensure

project elements are appropriately designed and constructed, consistent with the current California Building Code earthwork standards and USACE and CVFPB standards. With adherence to these standards and any additional recommendations of the site-specific geotechnical investigation, impacts associated with potential adverse soils conditions would be **less than significant**. No mitigation is required.

These alternatives would have no short-term or long-term effects on the acquisition, mining or processing of the mineral resources in the project area. None of the existing sand and gravel mining or processing operations are located at the work sites. Implementation of the project would not reduce or eliminate availability of mineral resources. However, the completed project would provide long-term FRM benefits by reducing the potential for loss of soils or mineral resources due to erosion and levee failure. The potential loss of locally or regionally significant mineral resources would be a **less than significant** impact. No mitigation would be required.

To identify potential locations for borrow material, soil maps and land use maps were obtained for a 25-mile radius surrounding the project area. Whenever possible, borrow sites would be obtained from willing sellers and located on land to minimize effects on the environment. Once details of borrow locations are finalized, coordination with the CDC SMGB would occur to ensure compliance with SMARA , including any additional permitting CEQA (as determined by the SMARA lead agency SMGB) or NEPA required prior to commencing surface mining at the borrow sites. After material is extracted, borrow sites would be returned to their existing use whenever possible.

5.3.5 MITIGATION

There would be no significant effects on soils and mineral resources, therefore no mitigation is required.

5.4 HYDROLOGY AND HYDRAULICS

This section describes the affected environment and environmental consequences relating to hydrology and hydraulics for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed.

Regulatory Framework

Federal

- CWA of 1972, 33 U.S.C §1251, *et seq.*
- FEMA National Flood Insurance Program, 44 CFR
- Safe Drinking Water Act of 1974, 42 U.S.C. §300f-300j-9)
- Rivers and Harbors Act of 1899, 33 U.S.C. §401, *et seq.*

State

- California Department of Water Resources Urban Levee Design Criteria
- Central Valley Flood Protection Plan
- Porter-Cologne Water Quality Control Act of 1970, California Water Code Sections 13000-16104

5.4.1 ENVIRONMENTAL SETTING

Existing Conditions

The LSJRFS study area includes 64 square miles of urban and agricultural lands subject to comingled flooding from multiple sources. Based on 2010 census data and floodplain mapping presented herein,

235,000 people reside within the study area's 0.2 percent (1/500) ACE Floodplain and are susceptible to being inundated by the primary sources of flooding identified in this study.

Precipitation in the project region occurs primarily during the months of November through March with normal annual precipitation ranging from about 13 inches near Tracy to 19 inches near Lodi (WRCC, 2014). At Stockton, the normal annual precipitation is 14 inches (WRCC, 2014). Winter storms are associated with frontal systems from the Pacific Ocean moving against the Sierra Nevada. As the moist air rises over the mountain range, it loses its ability to retain moisture, resulting in intense precipitation. The resulting floods are usually characterized by high peak flows of short duration, but when antecedent rainfall results in saturated ground conditions or when the ground is frozen, the volume of runoff is much greater and flooding is more severe. Thunderstorms lasting up to three hours can occur over small areas at higher elevations from late Spring through early Fall. Within the smaller catchments, thunderstorms can result in runoff with high peak flows of short duration and low volumes.

The study area is susceptible to flooding from the combination of 6 principal sources including the Delta, SJR, Calaveras River and Mormon Slough system, Bear Creek, French Camp Slough system and Mosher Slough. The main contributing drainage areas to the study area include the Sacramento River (25,200 square miles), SJR (13,500 square miles) and the Mokelumne River (1,200 square miles). Runoff within the study area is highly influenced by reservoir regulation. Interior drainage is not considered a principal source of flooding. The following describes the flood sources within the study area.

Sacramento-San Joaquin Delta

The Delta covers more than 1,000 square miles of Central California. A map of the Delta is provided as Figure 5-1. The Delta is located at the confluence of the Sacramento and SJRs at the head of Suisun Bay, the most easterly extending arm of the San Francisco Bay system. In general, the Delta extends from about Sacramento on the north, to Stockton on the south and near Pittsburg on the west. This region, which is very flat, was reclaimed from a natural tidal area by hundreds of miles of levees along natural and manmade waterways that divide it into 100 tracts locally known as "islands."

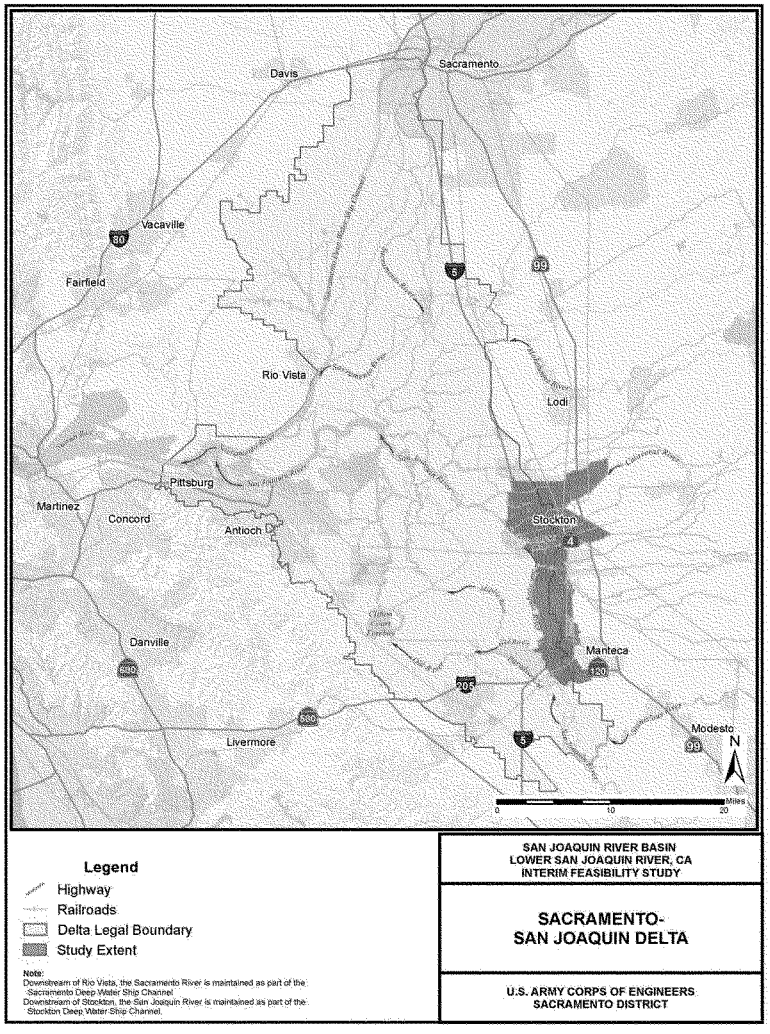


Figure 5-1: The Delta

Before the islands were reclaimed, much of the Delta was covered by water from the daily tide cycle. During times of high runoff from the Sacramento and SJR Basins, much of the Delta would be flooded. Reclamation of many of the Delta islands subjected the peat soils to oxidation. As a result, the interiors of most islands have subsided well below sea level. Elevations within the islands now range from just above mean sea level to 10 feet below mean sea level.

Maximum stages within the Delta result from runoff from storms of different origins that do not have the same annual exceedance frequency at all locations and from tides of varying magnitudes that seldom reach their maximum stages concurrently with the peak flows. In some years, the annual maximum stage at all locations occurs during the same storm event. However, in other years, the peak stages in the northern part of the Delta occur during a different time period than those in the southern part of the Delta and vice versa. The differences are caused by the geographical distribution of the contributing drainage basin, antecedent conditions such as snowpack and soil moisture and the fluctuation of the storm tracks over California. If the flood runoff is from the Sacramento River basin, the stages will be higher in the northern part of the Delta. If the flood runoff is from the SJR, then the stages will be higher in the southern part of the Delta.

The Delta Front reaches of the study area are susceptible to flooding from Fivemile Slough, Fourteenmile Slough and Tenmile Slough. These sloughs have relatively small tributary areas; however, the levees along these sloughs provide flood risk reduction from the large volume of water in the Delta. If a breach were to occur in a Delta Front levee, the floodwaters would likely equalize with the high stage of the Delta due to the enormous volume of water held in the sloughs and river channels.

San Joaquin River (SJR)

The SJR is the principal stream in the southern half of the Central Valley. It is a perennial stream sustained through the summer by melting snow and releases from reservoirs. Its main headwater tributaries, the south and middle forks, rise in glacial lakes in the southern Sierra Nevada. They join at an elevation of 3,600 feet NAVD88 to form the main stem, which flows west-southwesterly to the valley floor. The main stem then flows northwesterly down the main trough of the valley to the study area and its terminus at Suisun Bay. Upstream from the study area, the river is joined by several major tributaries flowing from the Sierra Nevada Mountain Range. There are also a number of minor low elevation tributaries that flow from the east and west and have little effect on flood flows and stages.

The major tributaries flowing from the east are the Stanislaus, Tuolumne, Merced, Chowchilla and Fresno Rivers. Less significant eastside tributaries comprise the Calaveras River, Bear Creek and French Camp Slough (terminus of Duck and Littlejohns Creeks systems). The principal Westside tributaries are Panoche, Los Banos, San Luis and Orestimba Creeks. Fresno Slough, a distributary of the Kings River that cuts through the valley-floor barrier ridge separating the Tulare Lake Basin from the SJR Basin proper, could contribute runoff to the SJR during extreme flood events. Reaches of the SJR within the study area are described below.

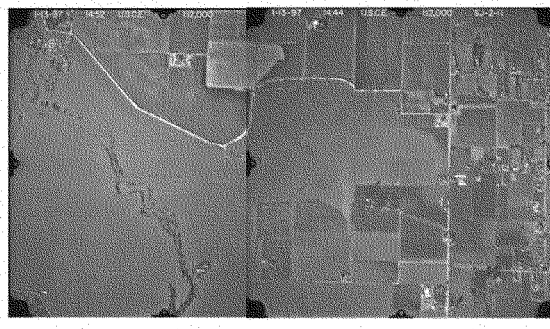
Stanislaus River to Paradise Cut. The confluence of the San Joaquin and Stanislaus Rivers defines the upstream extent of the hydraulic model used for this study. The USGS SJR at Newman stream gage is located at the upstream end of this reach, 2 miles downstream of the Stanislaus River. Within this reach, the SJR has a meandering plan form consisting of oxbows and cutoffs. The main channel varies in width from 300 to 600 feet. The floodway is contained by left and right bank levees that are 10 to 15 feet tall. The floodway between the levees varies in width from 900 feet to 4000 feet. The distance between the waterside levee toe and channel bank ranges from 0 feet to over 2000 feet. Flood stages within this reach are dominated by runoff from the SJR.

Paradise Cut to Old River. Paradise cut defines the upstream extent of this reach. Paradise cut is a distributary from the SJR that conveys floodwaters west into the Delta. The flow split is managed by

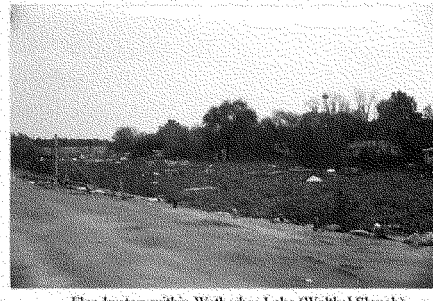
Paradise Dam, which is a 230 foot long rock weir along the left bank of the SJR. The flow split is defined by the hydraulic characteristics of the dam and a meander cutoff levee located on the SJR downstream of the dam. The meander cutoff levee extends west from the right bank levee and impinges on the SJR downstream of Paradise Cut.

Within this reach, the SJR transitions to a less sinuous plan form. The main channel varies in width from 300 to 600 feet. The floodway is contained by left and right bank levees that are 10 to 15 feet tall. At the upstream end of the reach, the floodway width between the levees varies from 900 feet to 4,000 feet and the distance between the waterside levee toe and channel bank ranges from 0 feet to over 2,000 feet. At the downstream end of the reach, the floodway width narrows to approximately 500 feet. However, there is 1 oxbow reach where the floodway is 2,000 feet wide. Flood stages within this reach are dominated by runoff from the SJR.

One mile downstream of Paradise Cut on the right bank is Wetherbee Lake and the upstream tieback levee of RD 17. The Wetherbee Lake levee segment along the SJR was a feature of the San Joaquin Flood Control Project, which cut off Walthall slough from the SJR to reduce damages to a resort development along the river. The RD 17 tieback levee is located downstream of Walthall Slough and extends east along the right bank to high ground. The RD 17 tieback levee is higher than the right bank levee of the SJR and diverts any floodwaters back into the SJR. This situation occurred in the flood of January 1997 and is shown on Figure 5-2. Flood stages within this channel reach are dominated by runoff from the SJR. Flood stages in the right overbank are dominated by runoff from the SJR and Stanislaus River.



Tieback Levee at Upstream end of RD17, 13 January 1997



Floodwaters within Wetherbee Lake (Walthal Slough)
upstream of RD17 Tieback Levee Looking East

SAN JOAQUIN RIVER BASIN
LOWER SAN JOAQUIN RIVER, CA
INTERIM FEASIBILITY STUDY

1997 FLOOD
WETHERBEE LAKE AND
RD17 TIEBACK LEVEE

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure 5-2: 1997 Flood Wetherbee Lake and RD17 Tieback Levee

Old River to French Camp Slough. Old River is a distributary from the SJR and conveys floodwaters west into the Delta. There is no hydraulic structure to manage the flow split, which is defined by the hydraulic characteristics of Old River and the SJR downstream of the flow split.

Within this reach, the SJR further transitions to a less sinuous plan form. The main channel varies in width from 200 to 300 feet. The floodway is contained by left and right bank levees that are 10 to 15 feet tall. From Old River to 4 miles downstream, the right bank levee is 3 feet taller than the left bank. The floodway width between the levees varies from 300 feet to 400 feet and widens to 1,400 feet at a few meander bends. The waterside levee face forms the channel bank along most of this reach. Flood stages within this reach are dominated by runoff from the SJR.

French Camp Slough to Burns Cutoff. French Camp Slough is a tributary to the SJR. The main channel varies in width from 200 to 300 feet. The floodway is contained by left and right bank levees that are 10 to 15 feet tall with a variable width between the levees of 300 feet to 400 feet. The waterside levee face is next to the channel bank along most of this reach. Flood stages are dominated by runoff from the SJR, but influence of ocean tides is evident in flood stage hydrographs.

Burns Cutoff to Deep Water Ship Channel. Burns Cutoff is a secondary channel of the SJR that conveys water on the west side of Rough and Ready Island. Burns Cutoff flows back to the SJR/Stockton Deep Water Ship Channel just downstream of the Calaveras River. The SJR main channel is 300 feet wide in this reach. The floodway is contained by left and right bank levees that are 10 to 15 feet tall. The right bank levee height tapers to high ground at the downstream end of the reach where it meets the San Joaquin Deep Water Ship Channel. The floodway width between the levees varies from 300 feet to 400 feet. The waterside levee face is next to the channel bank along most of this reach. Flood stages are dominated by runoff from the SJR. However, influence of ocean tides is evident in flood stage hydrographs.

Deep Water Ship Channel to Calaveras River. Within this reach, the SJR is maintained as a navigation channel through periodic dredging to a minimum draft of 35 feet below mean low water. The channel is 600 feet wide and is contained by high ground on either side. Smith Canal is located along the right bank of this reach, 1 mile downstream of the turning basin. The Calaveras River, a tributary to the SJR is near the downstream end of this reach. Flood stages within this reach are dominated by runoff from the Sacramento and SJRs in combination with ocean tides. Inflows from the Calaveras River and Smith Canal have a negligible influence because flood flows are not coincident with the SJR. In addition, the SJR has a relatively large cross sectional area due to channel dredging.

Calaveras River and Mormon Slough

The Calaveras River is a tributary of the SJR. Elevations in the drainage vary from 6,000 feet in the highest headwater areas to 30 feet in the lower part of the study area. A map of the watershed is provided in Figure 5-3. In the study area, the Calaveras River is distributary in nature. The stream divides into the north and south branches at Bellota, where a diversion structure was constructed as part of the Federal Mormon Slough Project. The northern branch Calaveras River flows westerly across the valley floor to join the SJR just west of Stockton. Very little flow enters this branch except during the summer when diversions are made for irrigation and ground-water replenishment. The southern branch, Mormon Slough, carries most of the flow. Its course extends in a general southwesterly direction from Bellota to the Stockton Diverting Canal flow diversion structure. The structure diverts all flood flows to the diverting canal, which discharges into the Calaveras River. The Mormon Slough reach below the diverting dam is referred to Old Mormon Slough. The source of flow in Old Mormon Slough is the local tributary area downstream of the diversion structure.

Bear Creek

Bear Creek is a tributary to Disappointment Slough of the Delta (Figure 5-4). At its confluence with Disappointment Slough, Bear Creek has a drainage area of 115 square miles. The watershed drains the western slopes of the Sierra Nevada foothills and has a maximum elevation of 1,000 feet NAVD88. The watershed is below the average snowline elevation. Based on preliminary hydrologic and hydraulic model analysis, Bear Creek was not found to be a source of flood risk to the study area. So, the results of the detailed hydraulic analysis for Bear Creek are not provided in this report.

Mosher Slough

Mosher Slough is a small tributary to Bear Creek, which discharges to Disappointment Slough of the Delta (Figure 5-6). The majority of the watershed is located in the urbanized area of Stockton between Interstate 5 and Highway 99 with the watershed area totaling 16 square miles (SJAFCA, 2012). The watershed's terrain has moderate slopes and reaches a maximum elevation of 65 feet NAVD88.

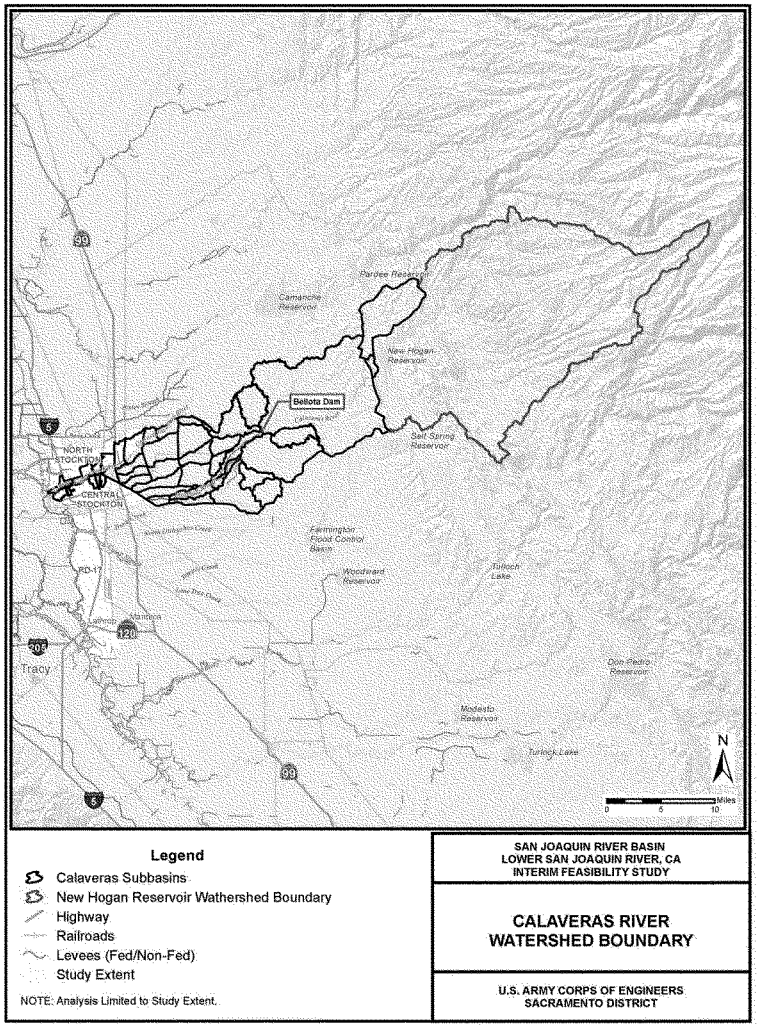


Figure 5-3: Calaveras River Watershed Boundary

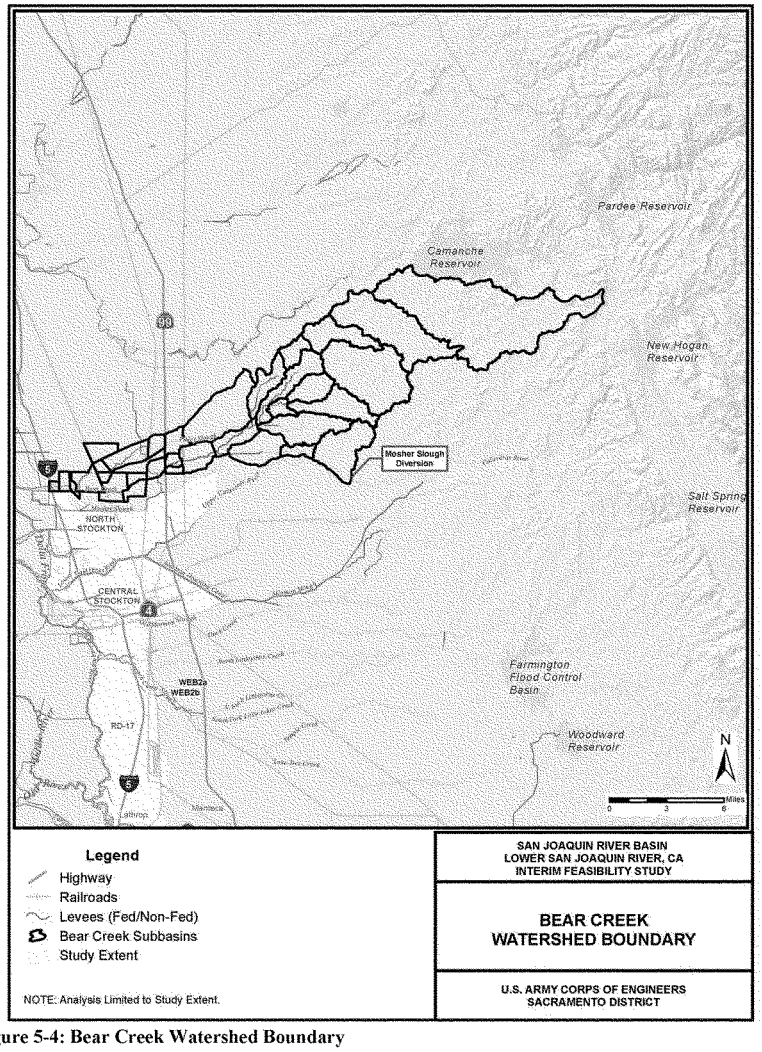


Figure 5-4: Bear Creek Watershed Boundary

French Camp Slough

French Camp Slough is a tributary to the SJR south of Stockton. The slough receives waters from Duck Creek and LittleJohn Creek (Figure 5-5). At its confluence with the SJR, French Camp slough has a drainage area of 430 square miles. The watershed drains the western slopes of the Sierra Nevada foothills and has a maximum elevation of 2,100 feet NAVD88. The watershed is significantly below the average snowline elevation. This slough, with or without upstream reservoirs, has no effect on major flood flows in the SJR (USACE, 1955).

Duck Creek

Duck Creek is a small tributary of the French Camp Slough south of Stockton, lying between the Calaveras River-Mormon Slough system and LittleJohn Creek. It has a total drainage area of 54 square miles (Figure 5-5). Reduction of flood flow in the stream is accomplished by the Farmington Reservoir Project, which prevents overflow of LittleJohn Creek floodwater into Duck Creek and the Duck Creek Diversion, which diverts floodwater from upper Duck Creek into the improved channel of LittleJohn Creek. Half of the Duck Creek drainage area lies above the Duck Creek Diversion Dam. The upstream area, about 28 square miles of typical foothills, lies below 500 feet in elevation with an overall streambed slope of 20 feet per mile. Downstream of the diversion structure, the gently sloping valley floor is a poorly defined tributary drainage area. This creek has no effect on major flood flows in the SJR.

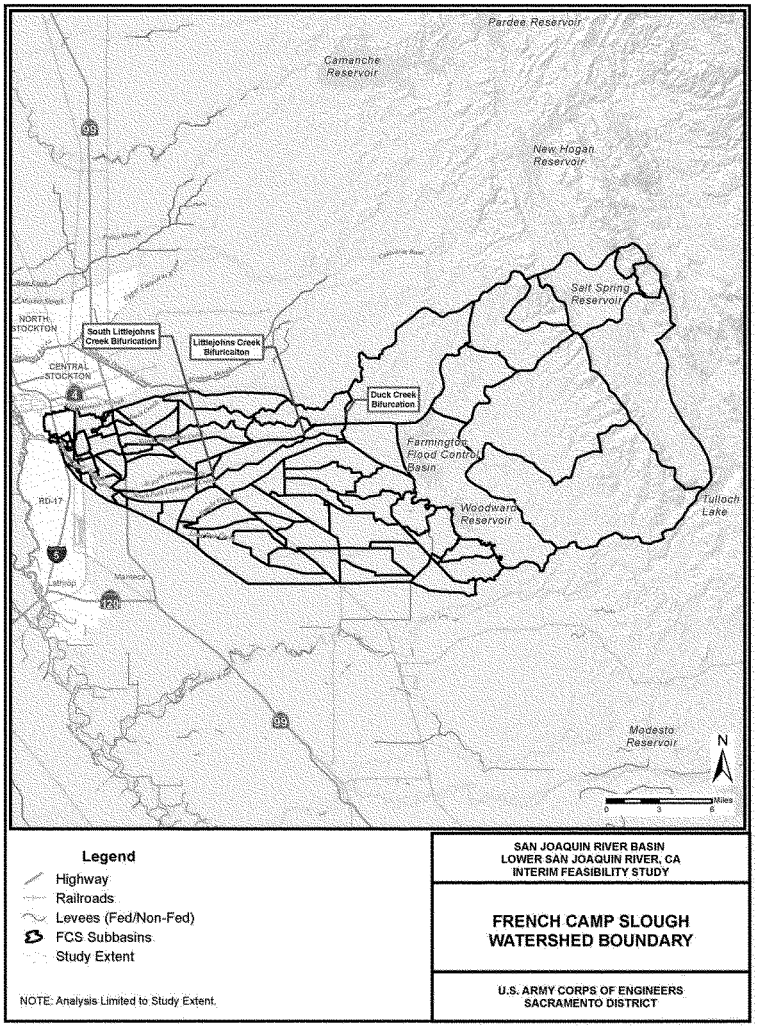


Figure 5-5: French Camp Slough Watershed Boundary

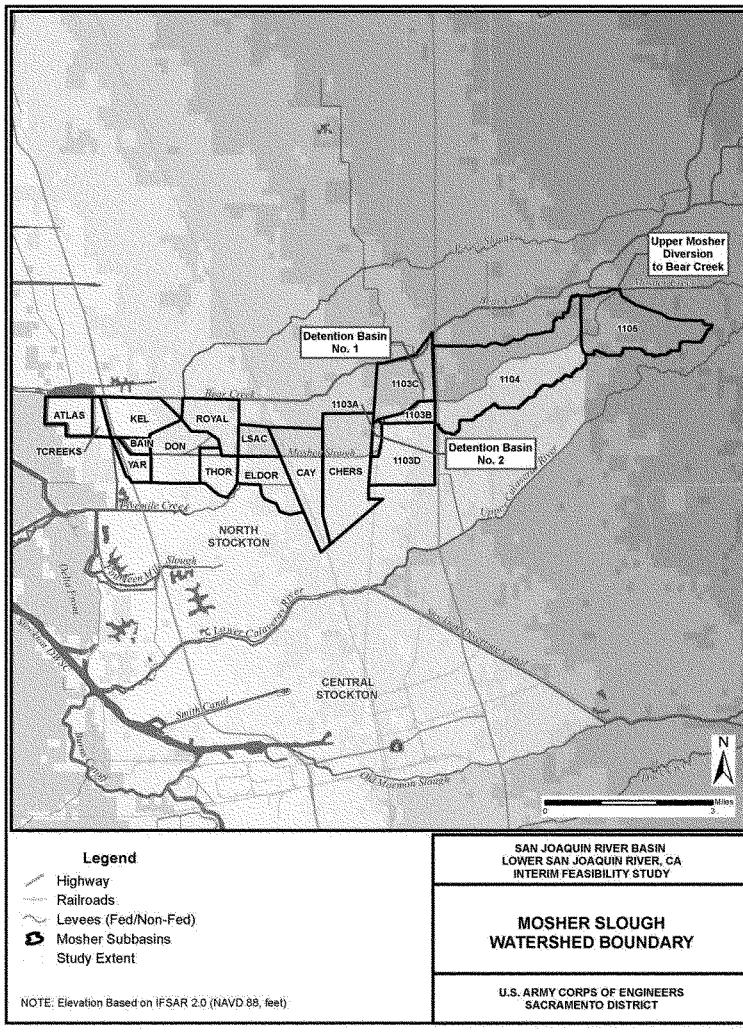


Figure 5-6: Mosher Slough Watershed Boundary

Flood Frequency and Floodplains

As described in Section 2.1.1, the study area has little topographic relief, which results in the potential for expansive flooding. The existing levee system in the project area reduces flood risk to over 71,000 acres of mixed-use land, approximately 235,000 residents and an estimated $28.7 billion in damageable property. Figure 2-2 shows the 0.2 percent (1/500) median ACE floodplain.

The frequency of observed historical floods is not directly comparable to the existing condition due to historical changes in the FRM system over time. Damage to the study area during known past floods would have been significantly reduced if the floods had occurred with presently existing FRM facilities completed and in operation. As a result, hydrologic frequency analysis and hydraulic modeling are necessary to evaluate the flood frequency and flood risk under existing and future conditions.

Figure 5-7 demonstrates the natural composite floodplain of the study area and areas susceptible to flooding if a breach in an existing levee was to occur during a flood event. For display purposes, the map includes dots where the hydraulic model was used to simulate a levee breach. The breach location is considered representative of the larger levee reach. The figures are provided over a range of flood frequencies from 50 percent (1/2) ACE to 0.2 percent (1/500) ACE. Since these maps do not account for levees providing any flood risk reduction, they do not represent actual flood risk. Rather, they demonstrate the areas vulnerable to flooding if a levee fails.

Figure 5-8 demonstrates how the floodplains have been altered by Federal and non-Federal levees within the study area. The Risk and Uncertainty (R&U) floodplain map shows an area flooded by a breach if the levee does not meet minimum assurance criteria of 90 percent. In other words, the R&U floodplain maps demonstrate how certain the levee system is able to prevent the area from being flooded for a given ACE event. If a levee has less than 90 percent assurance of passing the flood event, the area corresponding to an assumed breach is plotted on the map. The other way to interpret this is there is at least a 10 percent chance that the levee would fail at these locations for the given flood magnitude and the results of said failure. For display purposes the map includes dots where the hydraulic model was used to simulate a levee breach. The breach location is considered representative of the larger levee reach.

The performance based R&U floodplain maps show that the north and central Stockton areas have the highest probability of being flooded from the Delta Front levees. The maps also indicate the potential flood depths associated with a levee failure and can be used to assess flood losses including life safety, property damage, debris disposal, stormwater pollution, etc.

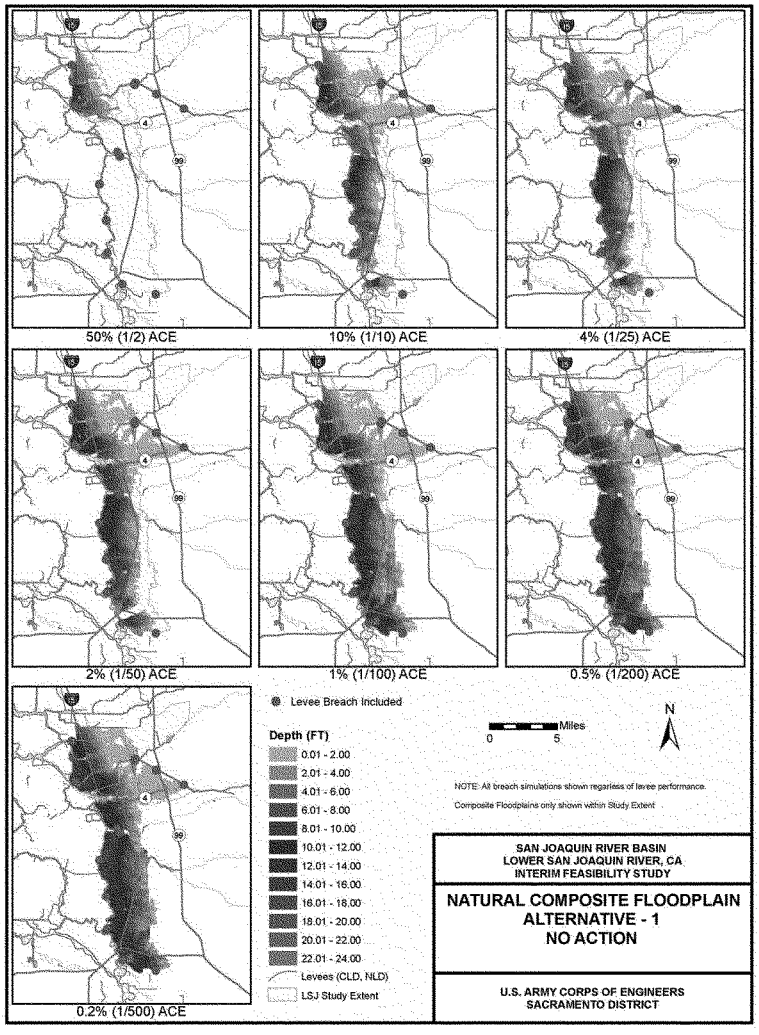


Figure 5-7: Natural Composite Floodplain—Alternative 1 (No Action Plan)

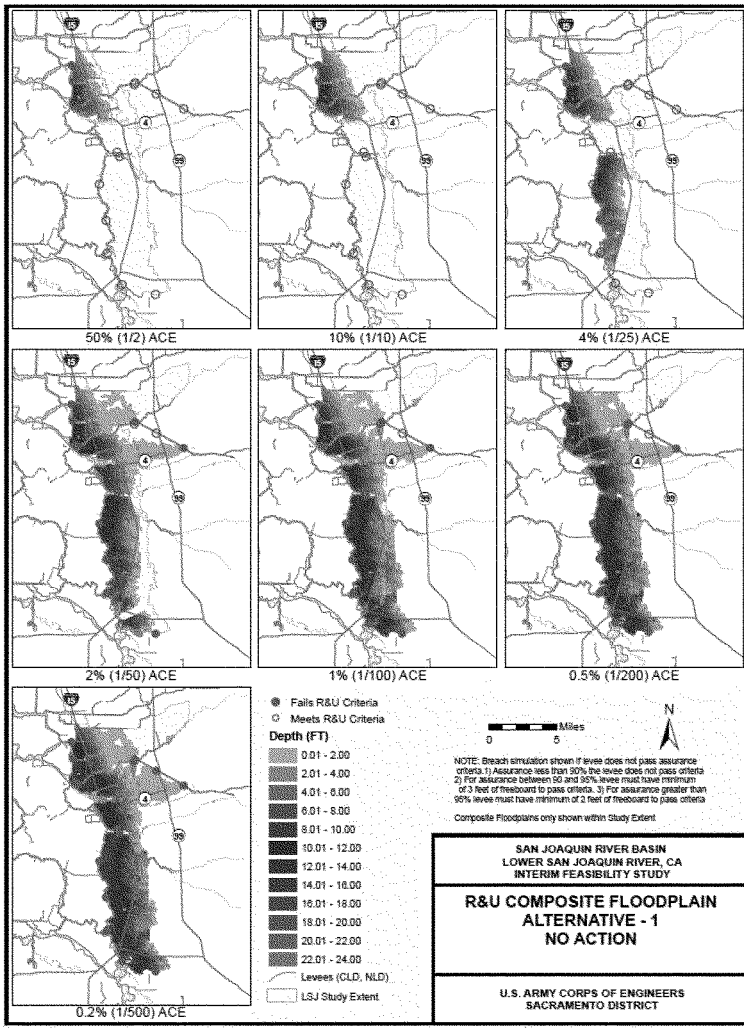


Figure 5-8: R&U Composite Floodplain—Alternative 1 (No Action Plan)

Most of the study area is currently designated by the NFIP as shaded zone x. Structures built within the NFIP shaded zone x are not required to be elevated above the 1 percent (1/100) ACE base floodplain. However, these areas are still considered to have a moderate to low risk of flooding due to hydrologic, hydraulic and geotechnical uncertainties. In other words, levees are not considered to be 100 percent reliable and there is always some risk of flooding from a levee breach.

5.4.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon analysis of historical flood events and adjustments to reflect existing and future hydrologic and hydraulic conditions. Analysis was performed using recorded gage data, hydrologic models, hydraulic models, geotechnical models and flood damage models. Analysis of alternative plans was performed by modifying the models to reflect the features of each alternative. The analysis incorporated a literature review and applied accepted standards of professional practice. The models and other analyses are consistent with the requirements of ER 1100-2-8162, Incorporating Sea Level Changes in Civil Works Programs, Curve II to account for sea level change over the design life of the project. Curve II was selected as a mean estimate, due to the uncertainty and consequences of flooding in a highly urbanized area. More detailed information on the hydrologic and hydraulic analysis is available in the appendices.

Basis of Significance

Effects on hydrology and hydraulics were considered significant if an alternative would result in any of the following conditions. These effects are based on NEPA standards, State CEQA Guidelines Appendix G (14 CCR 15000 et seq.) and standards of professional practice.

- Substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Place housing within a 1 percent (1/100) ACE special flood hazard area.
- Place within a 1 percent (1/100) ACE special flood hazard area structures which would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury or death involving flooding.

The primary purpose of the proposed project is to reduce the risk of flooding in the study area. The alternatives being considered would not place housing within a 100-year flood hazard area so this significance criteria is not addressed further.

5.4.3 ALTERNATIVE 1 – NO ACTION

Under the No Action Alternative, USACE would take no additional action to reduce the probability of flooding in the study area. The probability of flooding would be similar to the existing condition. In the future, the probability of flooding within the Delta Front areas will increase due to increases in sea level. The R&U floodplain map for Alternative 1 is provided in Figure 5-8. The map shows the area flooded by a breach in the levee if the levee does not meet minimum assurance criteria of 90 percent. The definition of the R&U floodplain map is provided in the description of the existing conditions.

The consequences associated with a flood could increase in the future as the damageable property in the floodplain increases due to development. However, Stockton, Manteca, Lathrop and the surrounding urban (10,000 people or more) and urbanizing areas are required by 2016 to develop a plan to obtain 0.5 percent (1/200) ACE level of flood protection by 2025, as required by SB 5.

Future projects under the No Action Alternative would be expected to comply with current and future regulations and design requirements of local, State and Federal agencies to limit changes in hydrology. Therefore, the No Action Alternative would not substantially alter existing drainage patterns, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.

The No Action Alternative would not contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; and would neither increase nor decrease the exposure of people or structures to a significant risk of loss, injury or death involving flooding. Therefore, the No Action Alternative would have a **less than significant effect** for these significance criteria.

Implementation of future FRM projects and compliance with flood regulations by local and State entities would ensure that the No Action Alternative would neither place housing nor structures within a 1 percent (1/100) ACE special flood hazard area nor place within a 1 percent (1/100) ACE special flood hazard area that would impede or redirect flood flows. Therefore, the No Action Alternative would have **no effect.**

5.4.4 ALTERNATIVE 7A

Under Alternative 7a, portions of North and Central Stockton are provided with additional FRM benefits through select levee raises and geotechnical improvements. The R&U floodplain map for Alternative 7a is provided in Figure 5-9. The map shows the area flooded by a breach of levees that do not meet minimum assurance criteria of 90 percent for a given flood event magnitude. The comparison of the No Action Alternative and Alternative 7A R&U floodplain maps indicate the increased FRM benefits of the project. Hydraulic models associated with Alternative 7a were modified to reflect the increased levee height measures, which would be limited to only levees that provide FRM to the study area. The levee along the right bank of French Camp Slough would be extended upstream to the UPRR rail yard to optimize protection to Central Stockton. Improving the levees in the project area would not increase stages and flows for channels and sloughs adjacent to north and central Stockton. Alternative 7a would have a significant **beneficial** impact by reducing the exposure of people or structures to significant risk of loss, injury or death involving flooding in the study area.

Alternative 7a includes construction and operation of two closure structures; one at Fourteenmile Slough and one at Smith Canal. These structures would reduce flood risk to north and central Stockton. The closure structures on Fourteenmile Slough and Smith Canal are intended to reduce the water surface elevation to areas behind those structures for floods greater than about a 30 percent ACE event. These structures reduce the probability of a levee failure by reducing the stage (hydraulic loading) of the levee. In addition, these structures reduce the consequences of a breach by limiting the volume of water that could flow through a breach from the Delta. Note that potential adverse impacts of the closure structures to water quality, waters of the U.S. and fisheries are discussed in the appropriate sections.

Alternative 7a would not substantially alter the existing drainage patterns of the site or area, including through alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site. However, a detailed sedimentation analysis has not been completed. The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce overall retention time and allow

sediment to fall out of suspension within portions of these channels. These reaches do not appear to have significant sources of suspended sediment. So, these impacts are considered **less than significant.**

Alternative 7a would not contribute runoff water in excess of current baseline conditions and would not exceed the capacity of existing or planned stormwater drainage systems, and so would have **no effect**.

Alternative 7a includes the placement of Fourteenmile Slough and Smith Canal closure structures within a 1 percent (1/100) ACE special flood hazard area. These structures would impede or redirect flood flows. However, these structures would either reduce or not change flood stages for a 1 percent (1/100) ACE flood. These impacts are considered to be **beneficial** or to have **no effect**.

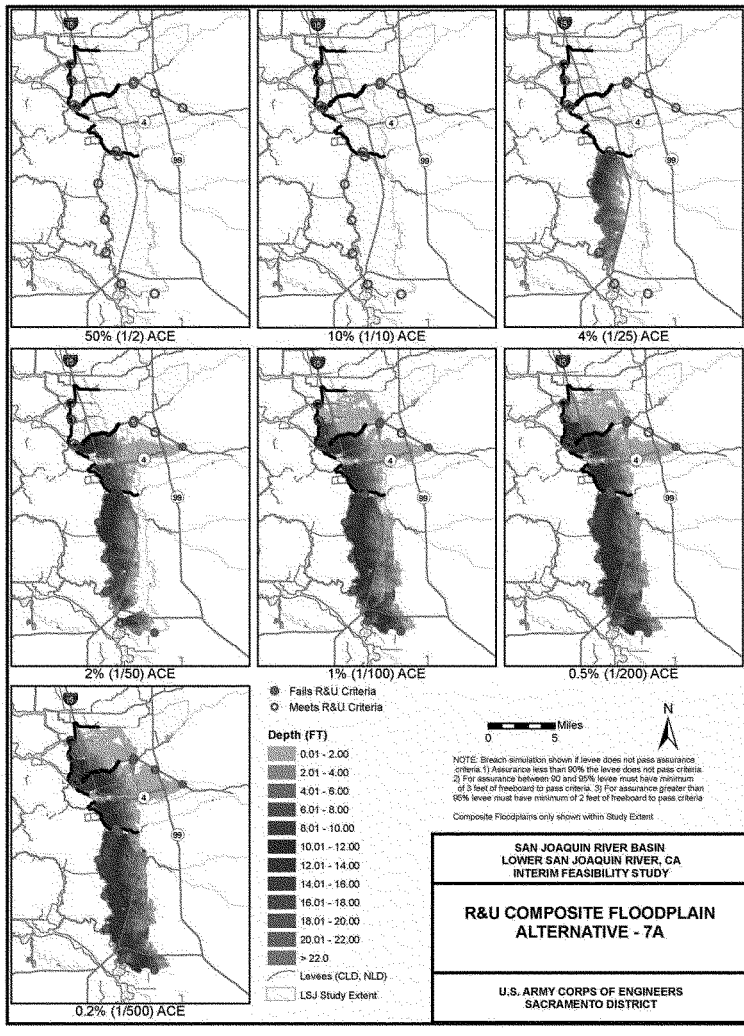


Figure 5-9: R&U Composite Floodplain—Alternative 7a

5.4.5 ALTERNATIVE 7B

Alternative 7b is the same as Alternative 7a, except that it includes additional levee fixes in RD 17 and lengthening and raising the RD 17 tieback levee. The R&U floodplain map for Alternative 7b is provided in Figure 5-10 and shows the area flooded by a breach for levees that do not meet minimum assurance criteria of 90 percent. The potential impacts of the levee improvements and closure structures are the same as described under Alternative 7a. For events greater than 1 percent (1/100) ACE the improvements to the RD 17 tieback levee would decrease the volume of floodwaters that would outflank the tieback levee and be conveyed by the floodplain east of the SJR channel in the No Action Alternative. In the No Action Alternative these floodwaters are conveyed by the floodplain within RD17 before discharging to the SJR and Stockton Deep Water Ship Channel. Alternative 7b improvements would reduce the probability of this outflanking and the floodwaters would instead be conveyed by the Old River, Middle River and SJR channels, resulting in increased channel stages for events greater than 1 percent (1/100) ACE event. The estimated increase in stage and flow for these channels is described in the Hydraulic Design Addendum. Alternative 7b would have a significant **beneficial** impact by reducing the exposure of people or structures to a significant risk of loss, injury or death involving flooding in the study area.

Alternative 7b would not substantially alter existing drainage patterns of the site or area, including through course alteration of a stream or river in a manner that would result in substantial erosion or siltation on or off site, but a detailed sedimentation analysis has not been completed. The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce the overall retention time and allow sediment to fall out of suspension within portions of these channels. These reaches do not appear to have significant sources of suspended sediment. The RD17 tieback levee improvements would be unlikely to increase erosion or siltation on or off site. These impacts are considered **less than significant.**

Although Alternative 7b improvements to the RD 17 tieback levee would likely increase stages along Old River, Middle River and SJR for events greater than 1 percent (1/100) ACE event, the increase in flood risk associated with these changes would be mitigated by the levee height and geotechnical improvements to the levees within the study area. The increase in flood risk outside the study area is considered **less than significant,** because the changes are for events rarer than a 1 percent (1/100) ACE event.

Alternative 7b would place within a 1 percent (1/100) ACE special flood hazard area structures that would impede or redirect floodflows. However, these structures would either reduce or not change flood stages for a 1 percent (1/100) ACE flood; therefore, the impact would be **less than significant**.

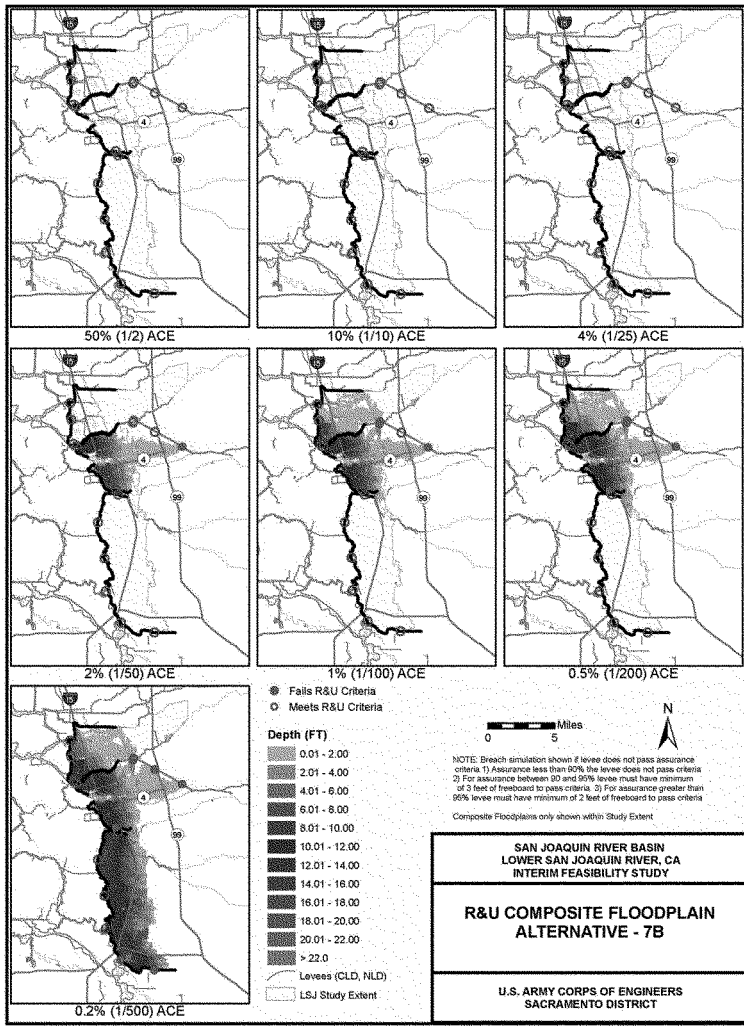


Figure 5-10: R&U Composite Floodplain—Alternative 7b

5.4.6 ALTERNATIVE 8A

Alternative 8a is similar to Alternative 7a, except that it includes additional levee improvements on the Lower Calaveras River and the Stockton Diverting Canal. The hydraulic design must meet current USACE design requirements, which combine the fix-in-place measures of cutoff wall, seismic deep soil mixing, seepage berm and levee geometry improvements. The R&U floodplain map for Alternative 8a is provided in Figure 5-11. The map shows the area flooded by a breach for levees that do not meet minimum assurance criteria of 90 percent.

Alternative 8a includes construction and operation of two closure structures; one at Fourteenmile Slough and one at Smith Canal. These structures would reduce flood risk to north and central Stockton. The closure structures on Fourteenmile Slough and Smith Canal are intended to reduce the water surface elevation to areas behind those structures for floods greater than a 30 percent ACE event. These structures reduce the probability of a levee failure by reducing the stage (hydraulic loading) of the levee. In addition, these structures reduce the consequences of a breach by limiting the volume of water that could flow through a breach from the Delta. Alternative 8a would have a significant **beneficial** impact by reducing the exposure of people or structures to a significant risk of loss, injury or death from flooding in the study area.

Alternative 8a would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site, but a detailed sedimentation analysis was not done. The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce overall retention time and allow sediment to fall out of suspension within portions of these channels. These reaches do not appear to have significant sources of suspended sediment. These impacts are considered **less than significant**.

Alternative 8a would neither contribute runoff water in excess of current baseline conditions nor exceed the capacity of existing or planned stormwater drainage systems and, therefore, would have **no effect**.

Alternative 8a includes the placement of Fourteenmile Slough and Smith Canal closure structures within a 1 percent (1/100) ACE special flood hazard area. These structures would impede or redirect flood flows. However, these structures would either reduce or not change flood stages for a 1 percent (1/100) ACE flood. These impacts are considered to be **beneficial** or to have **no effect**.

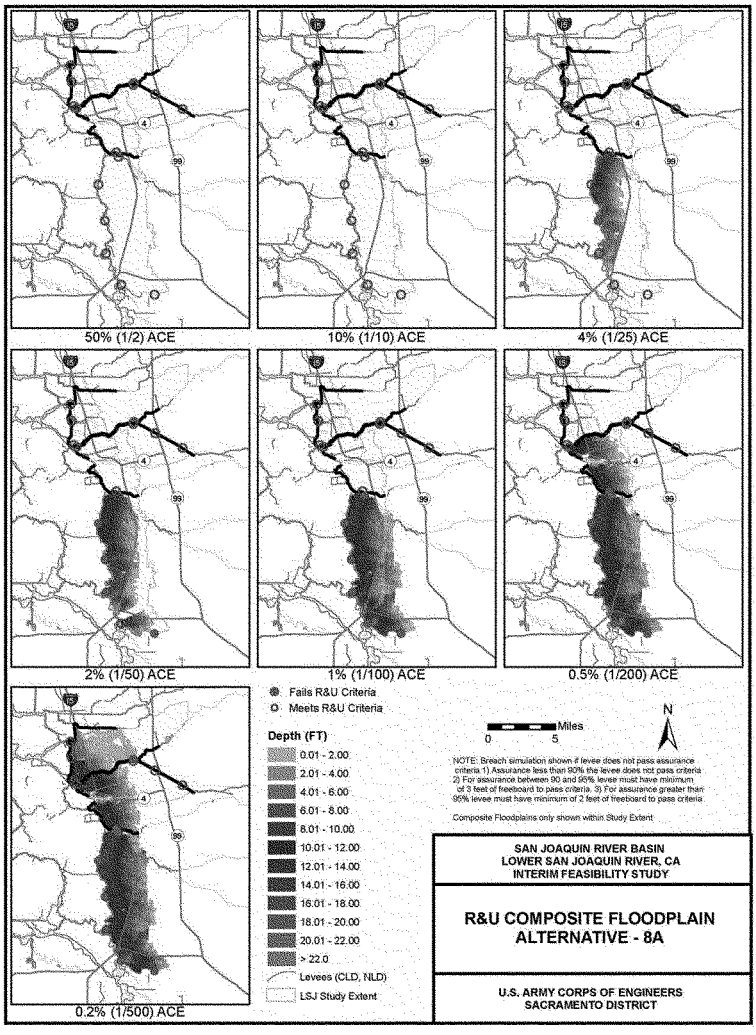


Figure 5-11: R&U Composite Floodplain—Alternative 8a

5.4.7 ALTERNATIVE 8B

Alternative 8b is the same as Alternative 8a, except that it includes additional levee fixes in RD 17 and lengthening and raising the RD 17 tieback levee. The potential impacts of the levee improvements and closure structures are the same as described under Alternative 8a for north and central Stockton. The R&U floodplain map for Alternative 8b is provided in Figure 5-12. The map shows the area flooded by a breach for levees that do not meet minimum assurance criteria of 90 percent.

For events greater than 1 percent (1/100) ACE, the improvements to the RD 17 tieback levee would decrease the volume of floodwaters that would outflank the tieback levee and be conveyed by the floodplain east of the SJR channel in the No Action Alternative. In the No Action Alternative, these floodwaters pond in the downstream urbanized portion of the RD17 floodplain before discharging to the SJR and Stockton Deep Water Ship Channel. Alternative 8b improvements would prevent this outflanking and the floodwaters would instead be conveyed by the Old River, Middle River and SJR channels, resulting in increased channel stages for events greater than 1 percent (1/100) ACE event. Alternative 8b would have a significant **beneficial impact** in reducing the exposure of people or structures to a significant risk of loss, injury or death involving flooding in the study area.

Alternative 8b would not substantially alter the existing drainage patterns of the site or area, including through course alteration of a stream or river, in a manner that would result in substantial erosion or siltation on or off site, but a detailed sedimentation analysis was not completed. The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce the overall retention time and allow sediment to fall out of suspension within portions of these channels. These reaches do not appear to have significant sources of suspended sediment. The improvements to the RD17 tieback levee would be unlikely to increase erosion or siltation on or off site. Therefore, these impacts are considered **less than significant**.

Although Alternative 8b improvements to the RD 17 tieback levee may increase stages along Old River, Middle River and SJR for events greater than 1 percent (1/100) ACE event, the increase in flood risk associated with these changes would be mitigated by levee height and geotechnical improvements to the levees. The increase in flood risk outside the study area is not considered significant, because the changes are for events rarer than a 1 percent (1/100) ACE event. Therefore, impacts are **less than significant**.

Alternative 8b includes the placement of Fourteenmile Slough and Smith Canal closure structures within a 1 percent (1/100) ACE special flood hazard area. These structures would impede or redirect flood flows. However, these structures would either reduce or not change flood stages for a 1 percent (1/100) ACE event and, therefore, would have a **less than significant impact**.

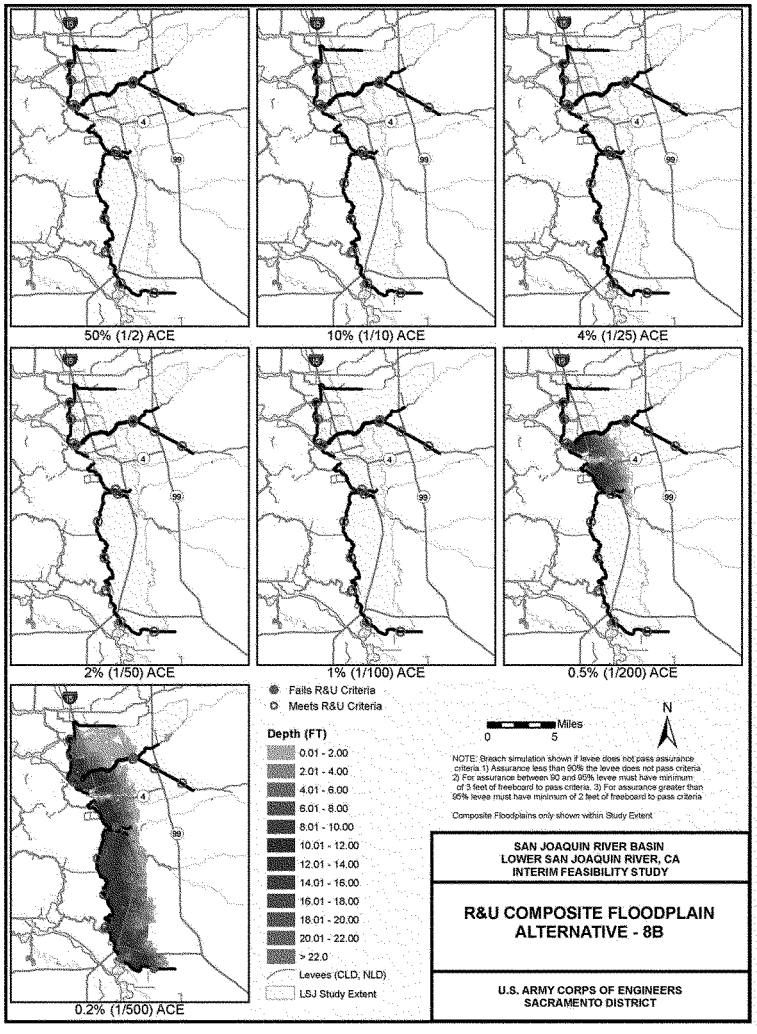


Figure 5-12: R&U Composite Floodplain—Alternative 8b

5.4.8 ALTERNATIVE 9A

Alternative 9a includes the same levee improvements and closure structures as Alternative 7a. In addition to these improvements, it includes a diversion structure on the Stockton Diverting Canal that would divert some high flows from the Stockton Diverting Canal into a new flood bypass (Mormon Channel flood bypass) in Old Mormon Slough. Flows into the Mormon Channel would occur every 5 years. The R&U floodplain map for Alternative 9a is provided in Figure 5-13 and shows the area flooded by a breach for levees that do not meet minimum assurance criteria of 90 percent. Alternative 9a would have a significant **beneficial** impact in reducing the exposure of people or structures to a significant risk of loss, injury or death involving flooding in the study area.

Alternative 9a would alter the course of a stream or river in a manner that would result in erosion or siltation on or off site. Construction and operation of a flood bypass in Old Mormon Slough would reduce the volume of flood flows moving through the Stockton Diverting Canal and the Lower Calaveras River in comparison with current conditions every other year. It would reintroduce flood flows to Mormon Channel every 5 years. The diverted flows will contain suspended sediments that will likely fall out of suspension in the Stockton Turning Basin. The bypass diversion may increase the amount of sediment deposition. However, in comparison to existing deposition rates, this impact is **less than significant**.

The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce the overall retention time and allow sediment to fall out of suspension with portions of these channels. A detailed sedimentation analysis was not completed. However, these reaches do not appear to have significant sources of suspended sediment. Therefore, these impacts are considered **less than significant**.

Alternative 9a would not contribute runoff water in excess of current baseline conditions and would not exceed the capacity of existing or planned stormwater drainage systems. Therefore, impacts would be **less than significant**.

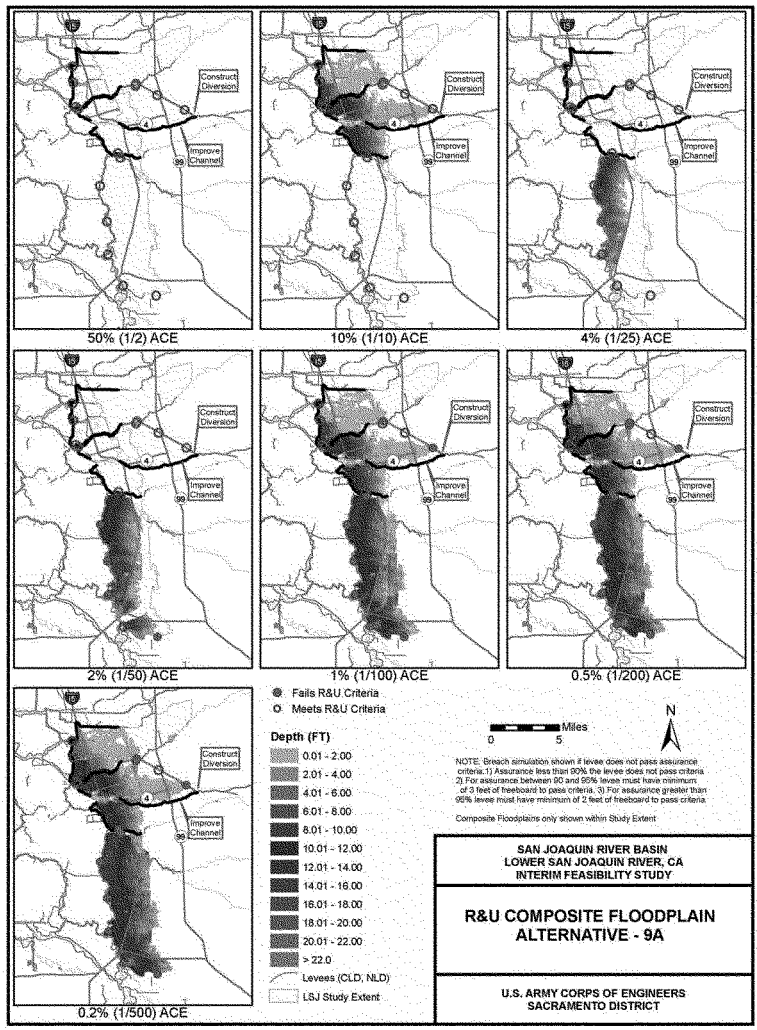


Figure 5-13: R&U Composite Floodplain—Alternative 9a

5.4.9 ALTERNATIVE 9B

Alternative 9b is similar to Alternative 9a, but includes additional levee fixes in RD 17 and improvements and an extension of the RD 17 tieback levee. The hydraulic design must meet current USACE design requirements that combine the fix-in-place measures of cutoff wall, seismic deep soil mixing, seepage berm and levee geometry improvements. The R&U floodplain map for Alternative 9b is provided in Figure 5-14. The map shows the area flooded by a breach for levees that do not meet minimum assurance criteria of 90 percent. Alternative 9b would have a significant **beneficial** effect in reducing the exposure of people or structures to a significant risk of loss, injury or death involving flooding in the study area.

Alternative 9b would alter the course of a stream or river in a manner that would result in erosion or siltation on or off site. Construction and operation of a flood bypass in Old Mormon Slough would reduce the volume of flood flows in the Stockton Diverting Canal and the Lower Calaveras River in comparison with current conditions every other year. It would reintroduce flood flows to Mormon Channel every 5 years. The bypass diversion may increase the amount of sediment deposition in the Stockton Turning Basin, but in comparison to existing deposition rates this impact is **less than significant**.

The closure structures on Fourteenmile Slough and Smith Canal may reduce the tidal exchange within these reaches by constricting the channel dimensions at the project site. This may reduce the overall retention time and allow sediment to fall out of suspension with portions of these channels. A detailed sedimentation analysis was not completed. However, these reaches do not appear to have significant sources of suspended sediment. Therefore, these impacts are considered **less than significant.**

Although Alternative 9b levee improvements to the RD 17 tieback levee would likely increase stages along Old River, Middle River and SJR for events greater than 1 percent (1/100) ACE event, it would not lead to changes in flooding downstream of the levee improvements. Further, Alternative 9b would not contribute runoff water in excess of current baseline conditions, nor exceed the capacity of existing or planned stormwater drainage systems. Therefore, impacts would be **less than significant**.

5.4.10 MITIGATION

For each of the alternatives, the proposed levee improvements would not result in substantial changes in water surface elevation and are, therefore, **less than significant** and no mitigation is needed. The closure structures on Fourteenmile Slough and Smith Canal are intended to reduce water surface elevation to areas behind those structures. They would reduce the stages for floods larger than a 30 percent (1/3) ACE event. This would be a beneficial FRM impact to north and central Stockton. No mitigation is needed.

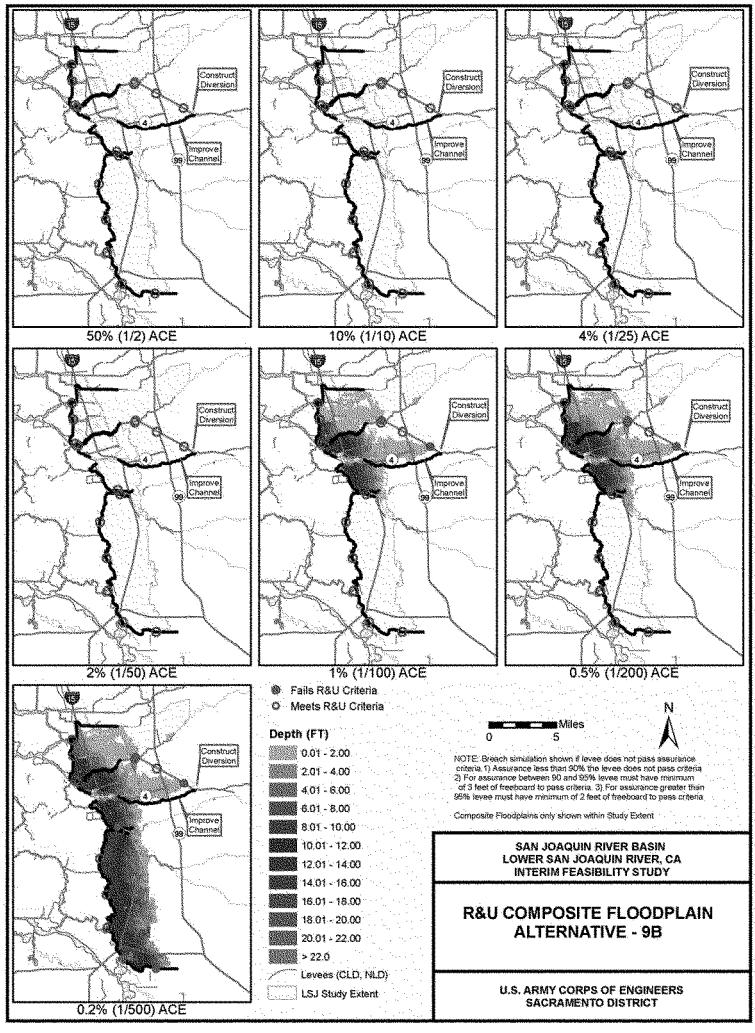


Figure 5-14: R&U Composite Floodplain—Alternative 9b

5.5 WATER QUALITY

This section describes the affected environment and environmental consequences relating to the water quality of surface waters. The significance of the impacts and mitigation measures to reduce impacts are also discussed. Effects on waters of the U.S. and wetlands are addressed separately in Section 5.7.

5.5.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to water quality are listed below and summarized in Chapter 7, Compliance with Applicable Laws, Policies and Plans.

Federal

- CWA Sections 404, 402, 401, 303
- NPDES

State

- Delta Plan (2013)
- Porter-Cologne Water Quality Control Act
- Statewide NPDES general permit for stormwater discharges associated with construction activities, as amended (Order 2009-0009-DWQ)

Local

- City of Lathrop General Plan (Goal 5, Policy 6; Goal 10)
- City of Manteca General Plan (Implementation RC-I-24)
- City of Stockton General Plan
- San Joaquin County General Plan (Objective 1; Objective 5, Policies 2 and 11)
- Water Quality Control Plan (Basin Plan) for the San Francisco Bay/San Joaquin Delta Estuary (1995, 2006, 2009)

Existing Conditions

The project area is in the southeastern portion of the Delta, within the legal boundary of the Delta, as defined by Section 12220 of the California Water Code. The legal Delta encompasses an area of 851,000 acres (of which 135,000 acres consist of waterway, marshland or other water surfaces). The Delta is divided into a Primary and Secondary Zone, as defined by the Delta Protection Act of 1992. Land uses in the Primary Zone are regulated to protect the area for agriculture, wildlife habitat and recreational uses. The Secondary Zone, where urban development activities occur, is where efforts should be taken to ensure that these activities do not adversely affect Delta waters, Primary Zone habitat or recreational uses. The SJR delineates the boundary between the Primary Zone to the west and the Secondary Zone to the east. The proposed project is located entirely within the Secondary Zone.

Surface waters in the Lower SJR Watershed include the river and its tributaries and secondary canals and irrigation ditches. Bear Creek, Mosher Slough, Tenmile Slough, Fivemile Slough, French Camp Slough and the Calaveras River all converge with the SJR in the vicinity of Stockton. The Stockton Diverting Canal routes water from Mormon Slough to the Calaveras River. Secondary canals and irrigation ditches are generally parallel to the larger surface waters in the project.

Surface Water Quality

In the San Joaquin Hydrologic Region, the overarching water quality issues are a result of depleted freshwater flows, municipal and industrial waste water discharges, salt loads in agricultural drainage and runoff and other pollutants associated with agricultural irrigation and production (such as nutrients, selenium, boron and organophosphate pesticides) (Central Valley RWQCB, 2007). In urban areas, stormwater drainage systems may contain heavy metals and chemicals generated from vehicles and yard chemicals from residential and commercial areas.

Water quality in the Delta and portions of the SJR are heavily influenced by the operations of the CVP and the SWP. Generally, Delta water quality is best during the winter and spring months and poorer through the irrigation season and early fall. Water quality in the SJR is influenced by factors such as rain and snowmelt runoff, reservoir operations and irrigation return flows in the SJR basin. Agricultural return flows commonly discharge elevated salt loads into the SJR. The SWRCB has set flow and water quality objectives at Vernalis, located just upstream from the proposed project. To meet the Vernalis objectives, the USBR supplements flows to the SJR with releases from New Melones Reservoir on the Stanislaus River (Northeastern San Joaquin County Groundwater Banking Authority 2004:44,45).

The latest version of the Section 303(d) list for California issued by the SWRCB (approved October 11, 2011) identifies impaired status for waterways in the project area. These impaired waterways include Mosher Slough, Tenmile Slough, Fourteenmile Slough, Stockton Ship Channel, Smith Canal, lower SJR, Old Mormon Slough, French Camp Slough and Duck Creek (Walker Slough). Potential source of pollution for all of the listed constituents in the basin include agriculture, urban runoff, storm sewers, resource extraction, municipal point sources and contaminated sediments (ICF 2014). The Environmental Addendum includes a table that identifies the impairment for each waterway. Impairments in the project area include: chlorpyrifos, dichlorodiphenyltrichloroethane (DDT), diazinon, dioxin, furan compounds, Group A pesticides, mercury organic enrichment/low DO, polychlorinated biphenyls (PCBs), Escherichia coli, sediment toxicity, electrical conductivity (EC), pathogens, invasive species and unknown toxicity.

The Stockton Deep Water Ship Channel portion of the SJR is being addressed by a Total Maximum Daily Load (TMDL) for dissolved oxygen (DO), which increased in the channel since 2007 after the City of Stockton installed a nitrificiation system at the wastewater treatment plant to reduce ammonia in the effluent (CSWRC 2012:1). TMDLs were initiated for organophosphorous pesticides (i.e., diazinon and chlorpyrifos), salinity and boron and selenium in the SJR watershed and for total dissolved solids (TDS) and mercury in Delta channels. TMDLs for the other listed pollutants are scheduled to be developed at various times over the next 10 years in accordance with priorities contained in the Section 303(d) list.

Major monitoring programs in the SJR include the DWR Municipal Water Quality Investigations Program and the DWR D-1485 Water Quality Monitoring Program. The City of Stockton also monitors ambient water quality to assess potential effects associated with discharges from the Stockton Regional Wastewater Control Facility. Data are collected at 5 water quality monitoring sites near RD 17 along the SJR. The Mossdale Bridge sampling site at the I-5 crossing over the SJR is near RD 17. The Vernalis sampling site is located near the town of Vernalis just upstream from the proposed project.

Salinity in the Delta is the result of tidal exchange with San Francisco Bay, variations in freshwater inflow from the San Joaquin and Sacramento Rivers, agricultural and urban exports/diversions and agricultural return flows. The salinity of surface waters is often measured by the concentration of TDS and EC, commonly used as a surrogate parameter upon which to evaluate TDS. Discharges from agriculture, wetlands, mines and industries have had greater concentrations during critical (drought) water years than during wet or above-normal water years. The *Water Quality Control Plan for the Sacramento-San Joaquin River Basins* (Basin Plan), adopted by the Central Valley RWQCB in 2006 and most recently updated in 2011, addresses water quality objectives and standards in the Basin Plan area. Historical data indicate that

seasonal water quality (April 1 to August 31) objectives for EC in the Delta were routinely exceeded in the SJR near Vernalis and at Mossdale Bridge; the standards were typically met at the other nearby monitoring locations (City of Lathrop 2001: 4.2-14).

Historical data show that the dissolved oxygen concentration regularly falls below the Basin Plan's minimum standards in the SJR near Stockton (City of Lathrop 2001: 4.2-15). Low or negative streamflow past Stockton reduces dilution and mixing, which reduces re-aeration of the water. Oxygen depletion in the water bodies in the Central Valley is typically highest in late summer and fall, when high temperature reduces the oxygen-carrying capacity of the water. This suggests that dissolved oxygen levels may be influenced by physical processes (temperature, saturation capacity) rather than biological processes (respiration and primary production) (SWRCB 2010: 3-2).

The distribution of ammonia in freshwater rivers and lakes is highly variable regionally, seasonally and spatially and depends on the level of productivity of the water body and the extent of inputs from organic matter. Ammonia may be acutely toxic at high concentrations or chronically toxic at low concentrations, depending on the length of exposure. Historical data indicate that ammonia concentrations at monitoring sites near RD 17 were below levels that would cause either acute or chronic toxicity (City of Lathrop 2001: 4.2-17). Kjeldahl nitrogen is nitrogen in the form of organic proteins or their decomposition product, ammonia, as measured by the Kjeldahl method. During December 2007, Kjeldahl nitrogen levels near RD 17 had a high of 1.4 mg/L. Dissolved inorganic nitrogen is a measure of total ammonium (NH_4), nitrate (NO^3) and nitrite (NO^2), the nitrogen forms immediately available for assimilation by phytoplankton. During December 2007, dissolved inorganic nitrogen levels were found to be 3.74 mg/L. The high values observed in the Delta may be due to runoff and drainage from agricultural operations on the SJR (SWRCB 2010: 3-5, 3-6).

Trace elements may affect aquatic organisms directly or may affect human health or wildlife through water consumption or through bioaccumulation in fish or shellfish consumed by humans or high-end predators. The State is currently developing a TMDL program for mercury in the Delta that would result in the identification of a regulatory target(s), determination of sources and their associated loads, development of a quantitative model to predict loading and implementation of a mercury control program to reduce loads to comply with water quality objectives.

Results from recent Delta sampling showed concentrations above historical ranges (SWRCB 2010: 3-11 to 3-17). Measured parameters exhibited seasonal variation and changes in response to significant rainfall events or changes in flow rates.

Gates

Permanent and temporary gates and barriers are present throughout the Delta and Suisun Marsh. They are used to manage water quality, keep fish away from water supply export pumps, maintain water levels and reduce flood risk (Wilson: 2013). Additional gates are under study, such as those associated with the Franks Tract Project and the Two-Gates Project. Ongoing operational considerations include management of increased aquatic predator populations and passage for recreational uses.

5.5.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

A project alternative would create a significant water quality impact if it would:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality; or
- Create or contribute runoff water that would provide substantial, additional sources of non-point source polluted runoff.

Since the Draft FR/EIS/EIR was published, Moffatt & Nichol completed hydrodynamic modeling and a water quality residence time analyses for the gated fixed wall structure proposed by SJAFCA as part of their early implementation project. The modeling is described in Appendix B of the Smith Canal Gate Project EIR (State Clearinghouse No. 2014062079) (November 2015) and results are discussed in Section 3.2 of the EIR. Both documents are available on SJAFCA's website (http://www.sjafca.com/smith_canal_closure.php) and are available for inspection at SJAFCA's offices at 22 E. Weber Ave., Suite 301, Stockton at 95202. This information is incorporated by reference and summarized in the sections below describing impacts. The following text is from the EIR:

MIKE-21 software was used to develop a model of Smith Canal, Atherton Cove and the nearby section of the San Joaquin River. The model was used to simulate velocity, stage, transport and residence time for each alternative. Residence time refers to the average amount of time that a particle spends in a particular system, providing a measure of the rate at which waters in a particular system would be renewed. Residence time provides a method for assessing water quality.

The model results indicate that residence time would be unaffected by any of the proposed gated fixed wall structures because the gate opening would still be sufficiently large to enable tidal flow to propagate into Smith Canal and Atherton Cove without causing tidal muting. The model results demonstrate that residence time varies greatly from the outer portion of Smith Canal, through the canal and into Yosemite Lake because of the narrow and elongated extent of Smith Canal. Typical residence times near the mouth of Smith Canal are around 1 day, whereas residence times approximately midway into the canal approach 30 days. Residence times in the back of the canal and into Yosemite Lake exceed 40 days. The residence time in Atherton Cove is very short, less than 2 days, indicating good flushing and circulation.

While acknowledging the potential consequences of continued elevated flood risk, this impact analysis evaluates potential impacts of the 6 alternatives in relation to continuation of current conditions and maintenance practices that would be reasonably expected to occur in the foreseeable future if the project were not implemented.

5.5.3 ALTERNATIVE 1 - NO ACTION

For the purpose of this environmental impact analysis, the No Action Alternative assumes that no construction activities or levee vegetation removal beyond routine maintenance would occur. The water quality conditions would remain as described for existing conditions. The current level of risk would remain for a levee failure and flooding within the project area. Flooding of urban and agricultural lands would be likely to result in pollution of the SJR and contribute to temporary and long-term water quality degradation and nonattainment of designated uses. Flooding could inundate urban areas, exposing them to petroleum products, solvents, pesticides, nutrients and other pollutants. These materials could be transported onto adjacent agricultural lands and into waterways. Where flooding occurs on agricultural lands, runoff of pesticides and nutrients into natural areas would be expected. Polluted flood flows would either return to the SJR via overland flow or be collected by drainage systems and discharged to the SJR.

The magnitude of the impacts would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.5.4 ALTERNATIVE 7A

Construction activities have the potential to temporarily impair water quality if disturbed and eroded soil, petroleum products or construction-related wastes (e.g., cement and solvents) are discharged into receiving waters or onto the ground where they can be carried into receiving waters. Soil and associated contaminants that enter receiving waters can increase turbidity, stimulate algae growth, increase sedimentation of aquatic habitat and introduce compounds that are toxic to aquatic organisms. Accidental spills of construction-related substances such as oils and fuels can contaminate both surface water and groundwater. The extent of potential impacts on water quality would depend on the tendency for erosion of soil types encountered, types of construction practices, extent of the disturbed area, duration of construction activities, timing of particular construction activities relative to rain events, proximity to receiving water bodies and sensitivity of those water bodies to contaminants.

Alternative 7a would require extensive ground-disturbing activities including borrow site activities, closure structures, deep soil mixing and conventional cutoff walls. Much of the construction activities would occur near local drainages and waterways that could be contaminated by soil or construction substances. These waterways include the SJR, Mosher Slough, Tenmile Slough, Fourteenmile Slough, the Lower Calaveras River, Smith Canal, French Camp Slough and Duck Creek, in addition to agricultural drainage canals and local ponds.

Temporary impacts could result from construction of the cutoff walls and seismic remediation. Cutoff walls and seismic remediation would be constructed using soil-bentonite slurry, which has a fluid consistency during installation. The cutoff walls would be installed through the existing levee and extend to depths 50 to 70 feet below the levee crown. Seismic remediation involves installation of a grid of drilled soil-cement mixed columns, aligned longitudinally with and transverse to, the alignment of the levee extending beyond the levee prism. Improper handling or storage of the slurry or soil-cement material could result in releases to nearby surface water, degrading water quality. Further, seepage berms and realignment of the levee would require relocation of agricultural ditches and other permanent structures that could result in release of soil or other discharges to surface water.

The closure structures proposed for Smith Canal and Fourteenmile Slough would consist of a fixed sheet pile wall structure with an opening gate structure to allow for navigation and tidal movement of water. The opening portion would be a gate structure 50 feet wide attached to a concrete foundation using stainless steel anchor bolts. A sheet pile floodwall would be constructed adjacent to the control structures to tie the structures into the adjacent levee or high ground areas.

The construction of the closure structures is described in Sections 4.3.10 and 4.5.5. The gates would permanently affect about 0.5 acres of intertidal habitat at Fourteenmile Slough and 0.5 acres of tidally influenced open water riverine habitat at Smith Canal. Construction activities would affect an additional 1 acre of intertidal habitat at Fourteenmile Slough and 3 acres of tidally influence open water riverine habitat at Smith Canal. Temporary construction impacts would include localized increases in turbidity and unintended introduction of chemical contaminants.

At the time the Draft FR/EIS/EIR was published, hydrodynamic or residence time modeling for the closure structure at Smith Canal and the Draft FR/EIS/EIR reported no potential permanent and temporary, but recurring, water quality impacts including decreased dissolved oxygen and changes in salinity gradient eastward of the Fourteenmile Slough and Smith Canal gate and a finding of significant and unavoidable for

impacts associated with the closure structures and their operation. Modeling results show that water residence time in Smith Canal and Atherton Cove would change very little if a closure structure with a 50 foot wide gate where constructed at the mouth of Smith Canal. The model results showed a slight increase in residence time at the upstream end of Smith Canal (an increase from approximately 41 days to 42 days), but a slight decrease in residence time at the upstream end of Atherton Cover (a decrease from approximately 1.5 days to 1.4 days). The modeling results also concluded that the effect of the gated fixed wall structure on accumulation of contaminants organic material and nutrients would be less than significant and no mitigation would be necessary (ICF 2015). The closure structure on Fourteenmile Slough is expected to result in less than significant impacts on water quality because the design and operation is similar to the Smith Canal closure structure.

The gates would be exercised briefly (closed and immediately opened) once or twice a year. The gate would be closed when the delta stage is at 8.0 feet NAVD88 and rising and would be opened when the delta stage was 8.0 feet NAVD88 and falling. The gate would also be opened if the stage on the slough side of the gate rose higher than the delta stage. This would allow accumulated interior drainage behind the gate to flow out.One or both gates could be closed indefinitely in case of a levee failure occurred along Smith Canal or Fourteenmile Slough. The gate would be reopened once the levee repairs were made.

Even with this regular connectivity, existing water quality eastward of the gates would likely degrade for dissolved oxygen and invasive species and experience temporary but recurring degradation when the gates are closed. This may be most pronounced when the gates are closed for a few days to a few weeks when flood events occur concurrent with high tides. In these situations, contaminants entering the waters may result in increased concentrations of chlorpyrifos, DDT, diasinon, dioxin, furan compounds, Group A pesticides, mercury organic enrichment/low dissolved oxygen, pathogens and PCBs. Operation of the gates could have **significant** short-term effects on water quality; however, mitigation measures (Section 5.5.10) were identified that would reduce these impacts to **less than significant**.

Construction of the closure structures has the potential to result in temporary **significant** impacts to water quality. Parts of the closure structures extend from each bank into a portion of the waterway and the Draft FR/EIS/EIR reported that these structures had the potential to result in significant and unavoidable impacts on water quality. Recent hydrodynamic modeling determined that these permanent physical features would have a **less than significant** impact on water quality. If the proposed project is authorized and funded, before construction begins a SWPPP and a Bentonite Slurry Spill Contingency Plan (BSSCP) would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 7a would have a **less than significant** impact on water quality. The closure structures on Fourteenmile Slough and Smith Canal would have **less than significant** impacts on water quality. Gate operation (Chapter 4) could have a **significant** impact that would be mitigated to **less than significant** through the measures described in Section 5.5.10.

5.5.5 ALTERNATIVE 7B

The short- and long-term impacts described for Alternative 7a also apply to Alternative 7b since the proposed actions under these 2 alternatives are the same for the north and central Stockton areas. In addition, Alternative 7b includes improvements along the northern and western levees of RD 17. The nature of the potential improvement impacts are the same as those described above. The difference would be an additional 20.7 miles of levee improvements under Alternative 7b and no closure structures are being considered in RD 17.

Impacts associated with construction of in-water features (closure structures) and operation of the gates are the same as those described in Section 5.5.4. If the proposed project is authorized and funded, before

construction begins a SWPPP and a BSSCP would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 7b would have **less than significant** impacts to water quality. The closure structures on Fourteenmile Slough and Smith Canal would have **less than significant** impacts on water quality. Operation of the closure structures could have **significant temporary** impacts on water quality, which would be reduced to **less than significant** through the mitigation measures described in Section 5.5.10.

5.5.6 ALTERNATIVE 8A

Alternative 8a would have similar impacts to those described for Alternative 7a. Alternative 8a extends further up the Lower Calaveras River and include improvements to the Stockton Diverting Canal levees. Impacts associated with the construction and operation of in-water features (closure structures) would be the same as those described in Section 5.5.4. If the proposed project is authorized and funded, before construction begins a SWPPP and a BSSCP would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 8a would have a **less than significant** impact on water quality. The closure structures on Fourteenmile Slough and Smith Canal would have **less than significant** impacts on water quality. Operation of the closure structures could have **significant temporary** impacts on water quality that would be reduced to **less than significant** through the mitigation measures described in Section 5.5.10.

5.5.7 ALTERNATIVE 8B

Water quality impacts associated with this alternative would be similar in nature to those described for Alternative 7a, but would be potentially greater in extent because it would include improvements to an additional 20.7 miles of levee. Impacts associated with the construction and operation of in-water features (closure structures) would be the same as described in Section 5.5.4. If the proposed project is authorized and funded, before construction begins a SWPPP and a BSSCP would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 8b would have a **less than significant** impact on water quality. The closure structures on Fourteenmile Slough and Smith Canal could have **significant temporary** impacts on water quality that would be reduced to **less than significant** through the mitigation measures described in Section 5.5.10.

5.5.8 ALTERNATIVE 9A

Under Alternative 9a, similar activities to Alternatives 7a are proposed along the same linear extent with additional improvements in Old Mormon Slough. Water quality impacts would be similar in nature, but greater due to the increased footprint and volume of soils disturbed by construction of the Mormon Channel Flood Bypass. Impacts associated with construction and operation of in-water features (closure structures) is the same as described in Section 5.5.4. If the proposed project is authorized and funded, before construction begins a SWPPP and a BSSCP would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 9a would have a **less than significant** impact on water quality. The closure structures on Fourteenmile Slough and Smith Canal would have **less than significant temporary** impacts on water quality.

5.5.9 ALTERNATIVE 9B

Under Alternative 9b, similar activities to Alternatives 7b are proposed along the same linear extent with the addition of improvements in Old Mormon Slough. Water quality impacts would be similar in nature, but greater due to the increased footprint and volume of soils disturbed by construction of the Mormon Channel Flood Bypass. Impacts associated with construction and operation of in water features (closure structures) is the same as described in Section 5.5.4. If the proposed project is authorized and funded, before construction begins a SWPPP and a BSSCP would be prepared and water quality certification from the RWQCB would be obtained. BMPs would be implemented to avoid, minimize and mitigate effects on water quality during construction. Therefore, the potential for release of soil or construction-related materials in the waterways and local agricultural drainage canals under Alternative 9b would have a **less than significant** impact on water quality. The closure structures on Fourteenmile Slough and Smith Canal would have **less than significant temporary** impacts on water quality.

5.5.10 MITIGATION FOR ALTERNATIVES

Avoidance and Minimization Measures (BMPs)

- The contractor would prepare a spill control plan and a SWPPP prior to initiation of construction in accordance with guidance from the RWQCB, Central Valley Region. These plans would be reviewed and approved by USACE before construction begins.
- Implement appropriate measures to prevent debris, soil, rock or other material from entering the water. Use a water truck or other appropriate measures to control dust on haul roads, construction areas and stockpiles.
- Implement appropriate measures for handling and disposing of concrete and concrete washout water.
- Properly dispose of oil or other liquids.
- Fuel and maintain vehicles in a specified area that is designed to capture spills. This area cannot be near any ditch, stream or other body of water or feature that may convey water.
- Fuels and hazardous materials would not be stored on site.
- Inspect and maintain vehicles and equipment to prevent dripping oil and other fluids.
- Schedule construction to avoid the rainy season as much as possible. If rains are forecasted during construction, erosion control measures would be implemented as described in the RWQCB Erosion and Sediment Control Field Manual.
- Maintain sediment and erosion control measures during construction. Inspect the control measures before, during and after a rain event.
- Train construction workers in SWPPP and how to respond to, control, contain and clean up spills.
- Revegetate disturbed areas in a timely manner to control erosion.
- Materials will be covered and protected from wind, rain and runoff to avoid unwarranted dispersal.
- Construct culverts at Moreing Road to slightly reduce residence time at the upstream end of Atherton Cove (by approximately 0.2 days).
- Refine operational criteria to ensure that desired FRM benefits are achieved while avoiding degradation of water quality behind the closure structures.

In addition to the avoidance and minimization measures described above, design and operational criteria of the flood gates would be coordinated with RWQCB, NMFS, USFWS and CDFW to minimize potential water quality impacts. With mitigation and implementation of other CWA requirements, impacts associated with implementation of any of the alternatives (7a, 7b, 8a, 8b, 9a, 9b) would be **less than significant**.

5.6 GROUNDWATER

This section describes the affected environment and the environmental consequences that would result from implementing the LSJR Project and discusses the significance of the impacts and mitigation measures to reduce impacts.

5.6.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to water quality are listed below and summarized in Chapter 7. Few specific requirements were developed for or applied to groundwater. Those that apply to surface waters provide a framework for considering groundwater resources.

Federal

- CWA Sections 404, 402, 401, 303

State

- Delta Plan (2013)
- Porter-Cologne Water Quality Control Act
- Water Quality Control Plan (Basin Plan) for the San Francisco Bay/San Joaquin Delta Estuary (1995, 2006, 2009, 2011)

Local

- City of Lathrop General Plan (Goal 5, Policy 6; Goal 10)
- City of Manteca General Plan (Implementation RC-I-24)
- City of Stockton General Plan
- Eastern San Joaquin County Groundwater Management Plan (2004)
- San Joaquin County General Plan (Objective 1; Objective 5, Policies 2 and 11)

Existing Conditions

The SJR Hydrologic Region is divided into 3 groundwater basins, which are divided into 9 sub-basins totaling 9.7 million acres in area (DWR, 2009). The study area is associated with the Eastern San Joaquin and the Tracy Sub-basins. The Eastern tributaries of the LSJR are located in the Eastern San Joaquin Sub-basin. Most of the fresh groundwater is unconfined and occurs at depths of less than 2,500 feet (DWR 2006:169-170). The shallower aquifers are used as sources of freshwater. The region heavily relies on groundwater, which accounts for about 30 percent of the annual water supply used for agricultural and urban purposes (DWR 2003:25). Groundwater is used when and where surface water is unable to fully meet demands and has been used conjunctively with surface water to meet water needs since the beginning of the region's agricultural development.

Average annual seepage from surface water is estimated to be 141,127 AF (AF), average annual subsurface inflow is an estimated 3,586 AF and applied water recharge is 593,356 AF. Average annual agricultural and urban extractions are 761,828 and 47,493 AF, respectively. Thus, total estimated extraction exceeds total estimated recharge by 71,252 AF (DWR 2006:3).

Measurements since the 1960's show that groundwater levels declined continuously, resulting in significant groundwater depressions below and east of the City of Stockton. The largest of these depressions reaches

depths of more than 40 feet below mean sea level (DWR, 2006). On the east side of the Delta, declining water levels caused a 16-mile saline front to move eastward at a rate of 140 to 150 feet per year (USACE, 2006). Groundwater nitrate levels are elevated in large areas south of Stockton and east of Manteca extending towards the San Joaquin-Stanislaus County line (DWR, 2006).

In the Eastern San Joaquin Sub-basin, shallow and saline groundwater occurs within about 10 feet of the ground surface (DWR, 2009). Groundwater levels in the project area are generally very shallow as a result of the low elevation and proximity to the SJR channel. There are also localized areas of high TDS, nitrate, chloride, boron and organic compounds. TDS in the Eastern San Joaquin Sub-basin averages 310 milligrams per liter (mg/L) and can range from 30 to 1,632 mg/L. A total of 191 public supply wells were tested from 1994 to 2000 for primary and secondary inorganic contaminants, radiological contaminants, nitrates, pesticides and volatile organic compounds. Thirty nine percent of the tested wells exceeded USEPA maximum contaminant levels (MCL) for secondary inorganics and 11 percent of the tested wells exceeded the MCL for pesticides.

5.6.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature review and accepted standards of professional practice.

Basis of Significance

A project alternative would significantly impact groundwater if it would:

- 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 (if the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted) or
- Substantially affect the quality of the groundwater supply.

5.6.3 ALTERNATIVE 1 - NO ACTION

Development within Stockton and surrounding areas could reduce recharge rates as the area of impervious surfaces increases and a larger volume of surface flows are collected by surface drains. If current groundwater management practices continue, levels will continue to decline, storage will continue to be reduced and portions of the aquifer could become unusable due to the advancing inflow of higher salinity water from the west. In addition, potential contamination resulting from a flood event could limit the availability of groundwater.

The maximum sustainable yield from the aquifer is 0.75 to 1 AF, per acre per year. For the Delta Water Supply Project (DWSP), the City of Stockton selected a target extraction rate of 0.6 AF, per acre per year to reverse the historic overdraft and saline intrusion (City of Stockton 2007a, 2008a). The DWSP includes a storage and recovery program to address the City's long-term groundwater needs. In addition, the Eastern San Joaquin Groundwater Basin Management Plan includes groundwater banking and recharge projects, although specific implementation measures not been outlined. Although current groundwater supply is not sufficient for the anticipated growth, groundwater impacts would be reduced to **less than significant** through implementation of target extraction rates, banking projects and recharge projects. Further, compliance with local, Federal and State requirements would be implemented to reduce potential degradation of groundwater quality. Therefore, the No Action Alternative would have a **less than significant** impact on groundwater availability.

5.6.4 ALTERNATIVE 7A

Under Alternative 7a, cutoff walls, including jet grouting, would be installed along 23.7 miles of levees around north and central Stockton. This alternative would reduce the flood risk to areas behind the levee. The areas receiving increased protection are urban and mostly built out. Therefore, the current pattern of groundwater recharge and extraction would be expected to continue.

Use of cutoff walls introduces the potential for groundwater contamination during construction. Primary construction-related contaminants include sediment, oil and grease and hazardous materials. The slurry wall material is relatively benign and would not remain in a liquid state long enough to allow for significant lateral movement within the aquifer. Nevertheless, the release of contaminants into groundwater would be a **significant** impact.

In addition, cutoff walls could restrict the movement of groundwater towards and away from adjacent rivers, streams and canals, which could change localized near-surface groundwater levels in areas immediately adjacent to the cutoff wall. Shallow wells adjacent to the cutoff wall could be affected by changes in radial flow, either increasing yields or pumping costs. If yields decrease, a corresponding decrease in water quality could occur as the aquifer lowers and pumps take in more sediment. Cutoff walls may provide a potential benefit if they disrupt the eastward movement of saline waters.

Although some shallow wells near the cuttoff wall could be affected, recharge and overall flow to supply wells would not be appreciably affected. The proposed cutoff walls would reach depths of up to 70 feet. Since the upper water-bearing zone, the Victor Formation, extends from the ground surface to a maximum depth of 150 feet and is hydraulically connected to the underlying Laguna Formation, the cutoff wall would not isolate any portion of the shallow water-bearing zone. The cutoff wall should not affect the utility of existing or future water supply wells.

In the Central Valley, two detailed technical studies of potential effects of cutoff walls on groundwater were completed in the Sacramento Basin. These studies were for the Natomas Levee Improvement Project and the Feather River West Levee Project/Sutter Basin Pilot Feasibility Study (SAFCA 2007, USACE and SBFCA 2013). Both of these studies found that groundwater elevation would change by 3 feet or less. No similar studies were conducted in the San Joaquin Basin. In the absence of any other data, this impact analysis assumes that the potential impact of cutoff walls on groundwater would be similar to that identified for the two studies in the Sacramento River Basin and changes to groundwater elevations would be 10 to 50 feet or more below ground surface in the project area (San Joaquin County 2007). Further, the implementation of the project would not change land use such that the rate of groundwater recharge would decrease or effect well yields. Therefore, Alternative 7a would have a **less than significant** impact on groundwater supplies. Since there is uncertainty regarding effects on groundwater, the CSRA has been revised to acknowledge this uncertainty.

5.6.5 ALTERNATIVE 7B

Alternative 7b proposes the same repairs as Alternative 7a, but would also include improvements on the northern, western and southern levees in RD 17 and a section of new levee in the southern part of RD 17. Cutoff walls would be constructed on 34 miles of levee around north and central Stockton and RD 17. Potential impacts are the same as those described for Alternative 7a. Like north and central Stockton, the future growth anticipated by the proposed General Plan for RD 17 would not substantially deplete groundwater supplies if the proposed target extraction rate of 0.6 AF, per acre per year is met (City of Stockton 2007a, 2008a). For the same reasons outlined in Alternative 7a, Alternative 7b would have a **less than significant** impact on groundwater supplies and a potentially **significant** construction-related impact on groundwater quality.

5.6.6 ALTERNATIVE 8A

Alternative 8a proposes the same repairs as Alternative 7a, but also includes additional levee improvements on the Lower Calaveras River and along the Stockton Diverting Canal. Cutoff walls would be constructed on 31 miles of levee around north and central Stockton. For the same reasons outlined in Alternative 7a, Alternative 8a would have a **less than significant** impact on groundwater supplies and a potentially **significant** construction-related impact on groundwater quality.

5.6.7 ALTERNATIVE 8B

Alternative 8b proposes the same repairs as Alternative 7b, with some additional levee improvements on the Lower Calaveras River and on the Stockton Diverting Canal. Cutoff walls would be constructed on 45 miles of levee around north and central Stockton and RD 17. For the same reasons outlined in Alternative 7a, Alternative 8b would have a **less than significant** impact on groundwater supplies and a potentially **significant** construction-related impact on groundwater quality.

5.6.8 ALTERNATIVE 9A

Alternative 9a includes the same features as Alternative 7a, yet also includes establishing a flood bypass channel through Old Mormon Channel. About 20 miles of cutoff walls would be constructed in north and central Stockton. The establishment of Mormon Channel as a flood bypass could provide increased groundwater recharge. For the same reasons outlined in Alternative 7a, Alternative 9a would have a **less than significant** impact on groundwater supplies and a potentially **significant** construction-related impact on groundwater quality.

5.6.9 ALTERNATIVE 9B

Alternative 9b proposes the same repairs as Alternative 7b with the addition of channel modifications and related features in Old Mormon Slough to create a flood bypass. A total of 34 miles of cutoff walls would be constructed. The addition of flood flows to Old Mormon Slough could increase groundwater recharge. For the same reasons outlined in Alternative 7b, along with the potential for increased recharge, Alternative 9b would have a **less than significant** impact on groundwater supplies and a potentially **significant** construction-related impact on groundwater quality.

5.6.10 MITIGATION

Potential impacts to groundwater that could result from construction of the cutoff wall would be mitigated through development and implementation of a BSSCP, also known as a frac-out plan. A BSSCP is typically developed for activities that involve the use of bentoninte materials. It is intended to minimize the potential for a frac-out associated with excavation and tunneling activities, provide for timely detection of frac-outs and ensure a "minimum-effect" response in the event of a frac-out and release of excavation fluid. It would reduce potential impacts to groundwater to **less than significant**.

5.7 WETLANDS AND OTHER WATERS OF THE UNITED STATES

This section describes the affected environment and environmental consequences relating to waters of the U.S., including wetlands, and discusses the significance of the impacts and mitigation measures to reduce impacts.

5.7.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to water quality are listed below and summarized in Chapter 7.

Federal

- CWA Sections 404, 402, 401, 303
- ESA (Federal and State)
- EO 11990 (Protection of Wetlands)

State

- California Native Plant Protection Act
- Porter-Cologne Water Quality Control Act
- Section 1600 of the California Fish and Game Code

Local

- City of Lathrop General Plan (Goal 5, Policy 6; Goal 10)
- City of Stockton General Plan
- San Joaquin County General Plan (Objective 1; Objective 5, Policies 2 and 11)
- San Joaquin County Multi-species Habitat Conservation and Open Space Plan (SJCMSCP, San Joaquin County 2000)
- Water Quality Control Plan (Basin Plan) for the San Francisco Bay/San Joaquin Delta Estuary (1995, 2006, 2009, 2011)

Regulatory Definitions

"Waters of the United States" and wetlands are defined in 33 U.S.C. 1344. Waters of the U.S. include:

- All waters that are currently used or were used in the past or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to tidal ebb and flow;
- All interstate waters including interstate wetlands;
- All other waters such as intrastate lakes, rivers, streams including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce;
- All impoundments of water otherwise defined as waters of the U.S. under the definition;
- Tributaries of waters identified above;
- The territorial seas;
- Wetlands adjacent to waters (other than waters that are themselves wetlands identifies above;
- Waters of the U.S. do not include prior converted cropland or waste treatment systems designed to meet the requirements of CWA are not waters of the U.S.

"Wetlands" means areas that are inundated or saturated by surface or groundwater at a frequency and duration to support and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes and bogs.

For other water features such as rivers, streams and ditches, the extent of potential USACE jurisdiction is determined by identification of the Ordinary High Water Mark, defined as "that line on shore established by the fluctuations of water and indicated by physical character of the soil, destruction of terrestrial vegetation, the presence of litter and debris or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR §328.3[e]).

Existing Conditions

The LSJRFS project area supports waters of the U.S., including rivers, estuarine sloughs and wetlands. The wetlands and other waters of the U.S. in the project area are highly altered as a result of FRM projects, reclamation for agriculture and urbanization and navigation projects. These projects have resulted in general straightening and simplification of river, stream and slough structure.

The National Wetland Inventory (NWI) indicates several wetlands within and adjacent to the riparian zone of the SJR and its tributaries, but not none of these are in the footprint of proposed new levees.

Perennial Drainages

The perennial drainages in the project area are: SJR, lower Calavaras River, French Camp Slough, Duck Slough, Stockton Deepwater Ship Channel, Stockton Diverting Canal, Tenmile Slough, Fourteenmile Slough, Fivemile Slough, Smith Canal, Burns Cutoff, Mosher Slough/Creek, Paradise Cut, Old River North, Walthall Slough and Mormon Slough and Old Mormon Slough. The SJR and the lower reaches of its tributaries in the project area, the Stockton Deepwater Ship Channel and the sloughs around north Stockton are tidally influenced. Before construction of the Stockton Diverting Canal, Old Mormon Slough was perennial in most years. Today, the channel receives local stormwater runoff and intermittently contains water.

Perennial to Intermittent Drainages

Landside levee toe drains are present throughout the project area. Agricultural canals and ditches are present in agricultural lands outside urban areas. In the project area, most of these agricultural canals and ditches are located on Shima Tract, Wright-Elmwood Tract and in RD 17. Levee toe drains and agricultural ditches may contain water seasonally or year-round.

Ponds

Small ponds are located eastward of the SJR levee in RD 17. Manmade ponds exist in north Stockton and in the northern part of RD 17, but are part of residential developments and will not be affected by this project and are, therefore, not treated in this impact analysis.

Emergent Wetland

Narrow bands of emergent wetlands are present along some portions of the SJR, its tributaries and along the sloughs in the vicinity of north Stockton. Wetlands occupy both freshwater and brackish areas. For example, freshwater habitat exists along the SJR and upstream tributaries while the downstream sloughs, like Fourteenmile Slough are brackish. Greater expanses of emergent wetlands are present in areas that have a waterside bench in the canal such as the tip of RD 17 that joins French Camp Slough. Some depressions that exist along the lower levees and adjacent to the waterside or landside of the levees contain wetland attributes.

Toe drains and agricultural and roadside ditches are routinely maintained to maintain flow capacity for FRM or agricultural purposes and, therefore, are frequently cleared of vegetation. Nevertheless, wetland vegetation is sporadically and intermittently present in and along these waterways. Toe drains and

agricultural ditches are dominated by a mix of native and nonnative aquatic and semi-aquatic plant species such as curly dock, African pricklegrass, floating water primrose, willow weed, annual beard grass and nutsedge (AECOM, 2011).

The Draft EIS/EIR for the RD 17 Early Implementation Project (AECOM, 2011) documents the presence of a freshwater marsh in a depression on the landside of the levee between Howard Road to the north and a dirt farm road on the south. Vegetation in the marsh is reported as being dominated by narrow-leaved cattail with Fremont cottonwood and red willow trees growing on the perimeter. The draft EIS/EIR also documents a limited amount of freshwater marsh around the edges of a constructed pond that is located on a large private estate and equestrian center east of the levee in RD 17. A second area of freshwater marsh is located just in RD 17 in an area of backwater on the SJR.

Channel Islands

These unique islands are present in the main channels in Fourteenmile Slough and in the Lower Calaveras River. Wetland vegetation is likely to be present around the edges of these islands.

5.7.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Wetlands and other waters of the U.S. were identified using USGS topographic maps, Google Earth Pro™, the NWI, online mapping layers and the San Joaquin County Multi-Species Habitat Conservation Plan (2000). The NWI was established by USFWS to conduct a nationwide inventory of wetlands. In general, NWI maps are drawn using USGS soil surveys, aerial photo analysis of vegetation patterns, visible hydrology and geographic position to provide an overview of wetlands within an area. Any wetland delineated by an NRCS office is also included on the NWI maps. Prior to project construction, field surveys would be conducted to identify and verify through a formal wetlands delineation their jurisdictional status under the CWA, Section 404.

Impact assessment for these wetlands and waters of the U.S. is based on determining where the project footprint, including the construction and operations footprints, directly or indirectly impacts wetlands and other Waters of the U.S. Potential impacts to emergent wetlands may be underestimated based upon the use of remote sensing tools rather than field evaluation. During later project phases, full field protocols will be used to identify and evaluate project impacts on all wetlands and other waters of the U.S.

USACE administers regulations under Section 404(b)(1) of the CWA, which establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. A draft 404(b)(1) evaluation was prepared (Environmental Addendum), which analyzed the alternatives and has demonstrated the avoidance of wetland impacts to the maximum extent practicable, the minimization of potential impacts and if determined necessary, compensatory mitigation for any unavoidable impacts. During the project design phase, additional refinements could further reduce impacts.

Basis of Significance

A project alternative would have a significant impact on waters of the U.S., including wetlands, if the following significance criteria are met:

- Substantial adverse effect on Federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption or other means.
- Substantial adverse effect on Federally protected waters of the U.S., through direct removal, filling, hydrological interruption or other means.
- Conflict with the provisions of an adopted habitat conservation plan, natural community's conservation plan or other approved local, regional or State habitat conservation plan.

While acknowledging the potential consequences of continued elevated flood risk, this impact analysis evaluates the potential impacts of the 6 action alternatives in relation to continuation of current conditions and O&M practices that reasonably would be expected to occur if the project were not implemented based on current approved and funded plans.

5.7.3 ALTERNATIVE 1 - NO ACTION

For the purpose of this environmental impact analysis, the No Action Alternative, assumes that no construction activities or levee vegetation removal beyond routine maintenance would occur in the near term. Routine levee, vegetation and channel maintenance would continue and be conducted consistent with all applicable laws, regulations and other requirements. Old Mormon Slough would continue to convey local stormwater runoff from adjacent lands but would not convey floodflows from the Stockton Diverting Canal and Mormon Slough.

The current level of risk would remain for a levee failure and flooding within the project area. Flooding of urban and agricultural lands would likely result in pollution of the SJR and downstream sloughs and contribute to temporary and long-term water quality degradation. Flooding could inundate urban areas, exposing them to petroleum products, solvents, pesticides, nutrients, soils and other pollutants. These materials could be transported onto adjacent agricultural lands and into waterways. Where flooding occurs on agricultural lands, runoff of pesticides, soils and nutrients into natural areas would be expected. Polluted flood flows would either return to the SJR via overland flow or be collected by drainage systems and discharged to the SJR. Flooding could also transport a wide variety of materials from the adjacent lands and deposit them into waters of the U.S. These could be trees and shrubs, cars, fences and other items commonly found in urban areas.

Depending on the location and magnitude of a flood event, damage to structures and facilities could be localized or more widespread and could require minor to extensive repairs and cleanup. Construction activities related to cleanup could potentially introduce contaminants from stormwater runoff and erosion, which could temporarily impair the receiving water. In addition, emergency repairs would likely require placement of fill into open water and wetlands in order to stabilize or reconstruct levees in the area. All of these effects would be considered significant, because they could result in substantial adverse effects on Federally-protected waters of the U.S. or CWA Section 404 wetlands through filling, including introduction of contaminants. The magnitude of the impacts would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.7.4 ALTERNATIVE 7A

Levee height fixes and slope reshaping measures proposed under Alternative 7a would impact waters of the U.S., including wetlands, in north and central Stockton. Impacts to waters of the U.S. are summarized in Table 5-4. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands. There would be no impacts to waters of the U.S. from cutoff walls and the seismic remediation measures.

Table 5-4: Impacts to Waters of the U.S.

Location	Feature	Habitat Type	Total Permanent Impacts	Total Temporary Impacts
Fourteenmile Slough	Closure Structure	Tidally influenced estuary slough	0.5 acres[1]	1 acre[1]
Smith Canal	Closure Structure	Tidally influenced riverine canal	0.5 acres[1]	3 acres[1]
Mosher Slough	Levee Reshaping, Vegetation ETL	Waterside wetlands	3 acres	0
Delta Front	Levee Reshaping, Vegetation ETL	Waterside wetlands	4 acres	0
Calaveras River	Levee Reshaping, Vegetation ETL	Waterside wetlands	1.75 acres	0
Duck Creek	New Levee	Waterside wetlands	2 acres	0
Landside Toe Drains and Ditches	Seepage berms, levee height fixes, levee reshaping	Open water, freshwater marsh and riparian shrub scrub in some locations.	N/A	Up to 40 acres
TOTAL IMPACT			1 acre	up to 44 acres

[1] Toe drains and ditches would be reestablished landward of the levee construction.

Levee Height Fixes and Slope Reshaping

Levee improvements would affect waterside wetlands where slope reshaping is required, as estimated in Table 5-4 above. Levee height fixes and slope reshaping may require relocation of the landward levee toe drain. These toe drains would be reestablished landward of the improved levee toe and would continue to function as it had prior to constructing the levee improvements.

Closure Structures

Two flood gates are proposed under Alternative 7a. These gates would be constructed in waters of the U.S. One gate would be constructed across Fourteenmile Slough and the other across Smith Canal. Closure structure construction is described in Section 4.3.10 and operation is described in Section 4.5.5. The new permanent closure structures would directly and permanently affect 0.5 acres of open water in Fourteenmile Slough and 0.5 acres in Smith Canal. Construction would directly and temporarily impact an additional 1 acre of open water in Fourteenmile Slough and 3 acres of open water in Smith Canal. Table 5-4 shows the acres of waters that would be affected by the in-water closure structures in north and central Stockton under all of the action alternatives, including Alternative 7a.

Vegetation ETL

Wetlands that may occur within or immediately adjacent to, the VFZ could be adversely affected by project implementation without a vegetation variance. If a vegetation variance is granted, it is estimated that approximately 25 percent of waterside vegetation would be allowed to remain in place on the lower 1/3 of the levee slope and within the waterside easement. Landside tree and shrub removal would directly or indirectly impact wetlands where equipment or personnel enter wetlands or alter drainage supporting those wetlands. Removal of trees and shrubs could impact wetlands by altering the character of the surrounding vegetation.

Borrow Areas

To construct Alternative 7a, 1,406,000 cy of material would be needed. Although specific borrow locations have not yet been identified, suitable material is available within 25 miles of the project. An estimated 190 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, implementing Alternative 7a would result in short- and long-term effects on waters, including wetlands, as a result of construction and operation of the 2 in-water closure structures. Construction would affect vegetation and aquatic organisms within the construction footprint and the structure would remain a permanent feature. Hydrodynamic modeling completed recently indicates that the closure structures would slightly alter local water circulation on a recurring basis (See Section 5.5). This change and the presence of the structure itself would potentially affect aquatic organisms in the vicinity. This alternative would also include temporary impacts associated with fill and relocation of landside toe drains and irrigation ditches. Therefore, project impacts on Federally protected waters would be significant. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable**.

5.7.5 ALTERNATIVE 7B

Improvements to the FRM system that are proposed under Alternative 7b would affect waters of the U.S., including wetlands, in north and central Stockton and in RD 17. Impacts to open waters are summarized in Table 5-4. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands.

Levee Height Fixes and Slope Reshaping

Under Alternative 7b, impacts from levee height fixes and slope reshaping in north and central Stockton would be the same as described under Alternative 7a. Alternative 7b also includes height fixes and slope reshaping along the northern, western and southern levees around RD 17. These improvements could affect waterside wetlands where slope reshaping is required. Levee height fixes and slope reshaping may require relocation of the landside levee toe drains that would affect wetlands in and adjacent to the toe drains. These toe drains would be reestablished landward of the improved levee toe and would continue to function as it had prior to constructing the levee improvements.

Seismic Remediation

Impacts associated with constructing seismic remediation in north and central Stockton are the same as those described for Alternative 7a. Seismic remediation would not require work in waters of the U.S.

Closure Structures

Impacts associated with construction and operation of the closure structures on Fourteenmile Slough and Smith Canal are the same as those for Alternative 7a.

Vegetation ETL

Impacts to wetlands and other waters of the U.S. that could result from vegetation clearing to comply with the Vegetation ETL are the same as those described for Alternative 7a, except that impacts under Alternative 7b would extend along the north, west and southern part of RD 17.

New Levees

Alternative 7b includes construction of two new levee segments. One would be a dry land levee connecting two leveed arms of a meander along the SJR and one would be a dry land levee in the southern portion of RD 17. Construction of these segments would require relocation of local drainage and irrigation ditches affecting wetlands and other waters in and adjacent to these drainages. These ditches would be reestablished landward of the new levees and continue to function as they had prior to construction of the new levee segments.

Seepage Berms

Seepage berms would be constructed landward of levee segments in RD 17. Construction would require relocation of some landside toe drains and local drainage and irrigation ditches affecting wetlands and other waters of the U.S. in and adjacent to these drainages. These drains and ditches would be reestablished landward of the seepage berms and continue to function as they had prior to construction. If emergent wetlands are present within the construction footprint, they would be filled by construction of the seepage berms.

Borrow Areas

To construct Alternative 7b, 3,869,000 cy of material would be needed. Although specific borrow locations have not been identified, suitable material is available in sufficient quantities within 25 miles of the project. An estimated 385 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, implementing Alternative 7b would result in potentially short- and long-term effects on waters, including wetlands, as a result of construction and operation of the 2 in-water closure structures in Fourteenmile and Tenmile Sloughs, which would permanently change the structure of these sloughs, slightly alter local water circulation, eliminate existing vegetation and sessile and slow moving organisms within the construction footprint and establish the structures as permanent features of Smith Canal and Fourteenmile Slough. In addition, the project would have temporary impacts associated with fill and relocation of landside toe drains and irrigation ditches. In comparison with Alternative 7a, implementing Alternative 7b would result in additional wetlands impacts associated with levee improvements and new levees in RD 17. Impacts on Federally protected waters would be **significant**. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable.**

5.7.6 ALTERNATIVE 8A

Improvements to the FRM system that are proposed under Alternative 8a would affect waters of the U.S., including wetlands, in north and central Stockton. Impacts to open waters are summarized in Table 5-4. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands.

Levee Height Fixes and Slope Reshaping

Under Alternative 8a, impacts from levee height fixes and slope reshaping would be the same as those for Alternative 7a, except that they would extend farther upstream on the lower Calaveras River and on the Stockton Diverting Canal west levee. The effects on waterside wetlands, landside toe drains and ditches would be the same as those for Alternative 7b.

Seismic Remediation

Impacts associated with construction of the seismic remediation are the same as those for Alternative 7a. Seismic remediation would not require work in waters of the U.S.

Closure Structures

Impacts associated with construction and operation of the closure structures on Fourteenmile Slough and Smith Canal are described under Alternative 7a. There would be no impacts beyond those described.

Vegetation ETL

Potential impacts to wetlands and other waters of the United States that could result from vegetation clearing to comply with the Vegetation ETL are the same as those for Alternative 7a. The impacts under Alternative 8a would also extend farther upstream on the Lower Calaveras River and the Stockton Diverting Canal. Woody vegetation in these additional areas is relatively sparse.

Borrow Areas

To construct Alternative 8a, 1,807,000 cy of material would be needed. Although specific borrow locations have not yet been identified, suitable material is available in sufficient quantities within 25 miles of the project. An estimated 266 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, implementing Alternative 8a would result in short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of the 2 in-water closure structures on Fourteenmile and Tenmile Sloughs, which would permanently change the structure of these sloughs, slightly alter local water circulation and eliminate existing vegetation and sessile and slow moving organisms in the construction footprint of the closure structures. In addition, the project would have temporary impacts associated with the fill and relocation of landside toe drains and irrigation ditches. Implementing Alternative 8a would result in greater wetlands impacts than Alternative 7a due to levee improvements along upstream reaches of the lower Calaveras River and the Stockton Diverting Canal. Alternative 8a would result in significant impacts on Federally protected waters. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable**.

5.7.7 ALTERNATIVE 8B

Improvements to the FRM system that are proposed under Alternative 8b would affect waters of the U.S., including wetlands, in north and central Stockton and in RD 17. Impacts to open waters are summarized in Table 5-4. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands.

Levee Height Fixes and Slope Reshaping

Under Alternative 8b, impacts from levee height fixes and slope reshaping would be the same as those for Alternative 7a, except that they would extend farther upstream on the lower Calaveras River and on the Stockton Diverting Canal west levee. Alternative 8b includes the same levee height fixes and slope reshaping in RD 17 as for Alternative 7b. Therefore, the effects on waterside wetlands, landside toe drains and ditches would be the same as those for Alternative 7b.

Seismic Remediation

Impacts associated with construction of the seismic remediation are the same as those for Alternative 7a. Seismic remediation would not require work in waters of the U.S.

Closure Structures

Impacts associated with construction and operation of the closure structures on Fourteenmile Slough and Smith Canal are the same as those for Alternative 7a.

Vegetation ETL

Potential impacts to wetlands and other waters of the U.S. under Alternative 8b that could result from vegetation clearing, in order to comply with the Vegetation ETL, are the same as those for Alternative 7a. Additional impacts to wetlands and waters of the U.S. under Alternative 8b would result from construction of the flood bypass through Old Mormon Slough.

Borrow Areas

To construct Alternative 8b, 4,270,000 cy of material would be needed. Although specific borrow locations have not yet been identified, suitable material is available in sufficient quantities within 25 miles of the project. An estimated 458 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, implementing Alternative 8b would result in short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of the 2 in-water closure structures on Fourteenmile and Tenmile Sloughs, which would permanently change the structure of these sloughs, slightly alter local water circulation and eliminate existing vegetation and sessile and slow moving organisms in the construction footprint. In addition there would be temporary impacts associated with fill and relocation of landside toe drains and irrigation ditches. In comparison with Alternative 7a, implementing Alternative 8b would result in additional wetlands impacts associated with levee improvements upstream on the lower Calaveras River and the Stockton Diverting Canal and on levee improvements and new levees in RD 17. Alternative 8b would result in **significant** impacts to Federally protected waters. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable**.

5.7.8 ALTERNATIVE 9A

Improvements to the FRM system that are proposed under Alternative 9a would affect waters of the U.S., including wetlands, in north and central Stockton. Impacts to open waters are summarized in Table 5-4. Alternative 9a would affect the length of Old Mormon Slough by constructing a flood bypass from the Stockton Diverting Canal through Old Mormon Slough to the Stockton Deep Water Ship Channel. Temporary construction impacts to Old Mormon Slough would be mitigated through BMPs and onsite compensatory mitigation, as appropriate. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands.

Levee Height Fixes and Slope Reshaping

Under Alternative 9a, impacts from levee height fixes and slope reshaping would be the same as those for Alternative 7a. There would be no impacts beyond those described.

Seismic Remediation

Impacts associated with construction of the seismic remediation are the same as those for Alternative 7a. Seismic remediation would not require in-water work.

Closure Structures

Under Alternative 9a, impacts associated with construction and operation of the closure structures on Fourteenmile Slough and Smith Canal are the same as those for Alternative 7a. There would be no impacts beyond those described.

Old Mormon Channel Flood Bypass and Diversion Structure

Under Alternative 9a, a diversion structure would be constructed through the Stockton Diverting Canal west levee at Old Mormon Slough and a flood bypass would be established through 6.3 miles of the Old Mormon Slough. Portions of Mormon Channel flood bypass would be excavated and graded to assure unimpeded flow conveyance. Three low-water road crossings would be removed and replaced with 3 bridges over the channel. Every 2 years, 1,200 cfs of flood flows would be conveyed through the Mormon Channel. Construction of these structures would result in short- and long-term impacts resulting from fill entering wetlands and waters of the U.S.

Vegetation ETL

Potential impacts to wetlands and other waters of the U.S. that could result from vegetation clearing to comply with the Vegetation ETL are the same as those for Alternative 7a and would result in the same impacts. However, Alternative 9a would result in additional impacts from construction of the flood bypass through Old Mormon Slough.

Borrow Areas

To construct Alternative 9a, 1,406,000 cy of material would be needed. Although specific borrow locations have not yet been identified, suitable material is available in sufficient quantities within 25 miles of the project. An estimated 190 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, implementing Alternative 9a would result in short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of the 2 in-water closure structures on Fourteenmile and Tenmile Sloughs, which would permanently change the structure of these sloughs, alter local water circulation and eliminate existing vegetation and sessile and slow moving organisms in the footprint of the closures structures. Alternative 9a would directly affect the channel and potential wetlands through excavation, grading and rewatering the channel with 1,200 cfs of floodflows every 2 years. In addition, Alternative 9a would result in fill and relocation of landside toe drains affecting wetlands. Alternative 9a would result in additional impacts resulting from levee improvements further upstream on the lower Calaveras River and on the Stockton Diverting Canal and from construction of a flood bypass through Old Mormon Slough. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable**.

5.7.9 ALTERNATIVE 9B

Improvements to the FRM system proposed under Alternative 9b would affect waters of the U.S., including wetlands, in north and central Stockton and in RD 17. Impacts to open waters are summarized in Table 5-4. Alternative 9a would affect the length of Old Mormon Slough by construction of a flood bypass from the Stockton Diverting Canal through Mormon Channel to the Stockton Deep Water Ship Channel. Temporary construction impacts to Old Mormon Slough would be mitigated through BMPs and onsite compensatory mitigation, as appropriate. Emergent wetland vegetation is present in narrow bands along the banks adjacent to these open water areas. Field surveys would be conducted during PED to specifically identify, quantify and determine the quality of these wetlands.

Levee Height Fixes and Slope Reshaping

Under Alternative 9b, impacts from levee height fixes and slope reshaping would be the same as those for Alternative 7a. Alternative 9b includes levee height fixes and slope reshaping along the northern, western and southern levees around RD 17, which could affect waterside wetlands where slope reshaping is required. Levee height fixes and slope reshaping may require relocation of the landward levee toe drain affecting wetlands in or adjacent to, the levees. These toe drains would be reestablished landward of the improved levee toe and would continue to function as it had prior to constructing the levee improvements.

Seismic Remediation

Impacts associated with construction of the seismic remediation are the same as for Alternative 7a. Seismic remediation would not require work in waters of the U.S.

Closure Structures

Impacts associated with construction and operation of the closure structures on Fourteenmile Slough and Smith Canal are the same as those for Alternative 7a.

Old Mormon Channel Flood Bypass and Diversion Structure

Under Alternative 9b a diversion structure would be constructed through the Stockton Diverting Canal west levee at Old Mormon Slough and a flood bypass (Mormon Channel) would be established through 6.3 miles of the Old Mormon Slough. Portions of Mormon Channel would be excavated and graded to assure unimpeded flow conveyance. Three low water road crossings would be removed and replaced with 3 bridges over the channel. Every 2 years, 1,200 cfs of flood flows would be conveyed through the Mormon Channel. Construction of these structures would result in short- and long-term effects from filling of wetlands and waters of the U.S.

Vegetation ETL

Potential impacts to wetlands and other waters of the U.S. that could result from vegetation clearing to comply with the Vegetation ETL are the same as those for Alternative 7a, except that impacts from would extend into RD 17.

Borrow Areas

To construct Alternative 9b, 3,869,000 cy of material would be needed. Although specific borrow locations were not identified, suitable material is available in sufficient quantities within 25 miles of the project. An estimated 385 acres would be needed to meet the borrow requirements. Creeks, ditches and wetlands in the vicinity of potential borrow materials would be avoided.

Based on this evaluation, Alternative 9b would result in short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of the 2 in-water closure structures on Fourteenmile and Tenmile Sloughs. These project features would permanently change the structure of Fourteenmile and Tenmile Sloughs and Smith Canal, alter local water circulation and eliminate existing vegetation and sessile and slow moving organisms from the footprint of the closure structures. Alternative 9b would construct and operate a new flood bypass (Mormon Channel) through Old Mormon Slough that would directly affect the channel and potential wetlands through excavation, grading and rewatering the channel with 1,200 cfs of floodflows every 2 years. Alternative 9b would result in temporary impacts associated with fill and relocation of landside toe drains and irrigation ditches, in additional wetlands impacts associated with levee improvements and new levees in RD 17 and construction of a flood bypass through Old Mormon Slough. Implementation of mitigation would reduce impacts to wetlands and waters of the U.S.; however, impacts would remain **significant and unavoidable**.

5.7.10 MITIGATION

Before construction, a qualified biologist would survey the project area and all wetlands and other waters of the U.S. would be subject to a formal jurisdictional determination and delineation to determine the extent and value of the wetlands affected. All delineated areas would be clearly marked and, to the extent feasible, avoided. Impacts would be minimized by establishing a buffer around wetlands and waterways. Construction worker awareness training would be conducted to ensure that personnel working the site know the location of and protocols for, working around sensitive habitat. Toe drains and local irrigation and drainage ditches would be relocated and restored with similar wetland habitat functions.

Compensation for permanent impacts to wetland and open water habitats would include the purchase of credits from an approved mitigation bank. The USACE is proposing to purchase 2 acres of bank credits for permanent impacts to open water habitat and 21.5 acres of bank credits for permanent impacts to wetland habitats. In addition, relocated landside levee toe drains and drainage ditches would be restored following construction to their pre-project condition.

Even with implementation of mitigation measures, including avoidance, minimization, restoration and compensatory mitigation, impacts from implementing each action alternative would remain **significant and unavoidable** due to the effects of construction and operation of the 2 in-water closure structures, which would permanently alter local water circulation and affect aquatic organisms.

5.8 AIR QUALITY AND GREENHOUSE GAS EMISSIONS

The following air quality and GHG emissions sections each include an environmental and regulatory setting section.

5.8.1 ENVIRONMENTAL SETTING

Regulatory Framework

Air Quality

Air quality management and protection are regulated by Federal, State and local levels of government. The primary statutes that establish ambient air quality standards and authorities to enforce regulatory attainment are the Federal CAA and California CAA.

Federal

The Federal 1970 CAA authorized the establishment of National health-based air quality standards and set deadlines for their attainment. The Federal Clean Air Act Amendments of 1990 (1990 CAAA) made major changes in deadlines for attaining National Ambient Air Quality Standards (NAAQS) and in the actions required of areas of the Nation that exceeded these standards. Under the CAA, State and local agencies in areas that exceed NAAQS are required to develop State Implementation Plans (SIPs) to show how they will achieve NAAQS for nonattainment criteria pollutants by specific dates. SIPs are not single documents; rather, they are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, State regulations and Federal controls. USEPA is responsible for enforcing NAAQS primarily through reviewing SIPs.

As required by the CAA, USEPA updates NAAQS for criteria air pollutants: ozone, CO, NO_2, SO_2, PM10, PM2.5 and lead (Pb). NAAQS for these pollutants are listed under "National Standards" in Table 5-5. They represent the upper bound pollutant concentrations deemed necessary by USEPA to protect the public health and welfare with an adequate margin of safety. Ozone is a secondary pollutant that is not emitted directly to the atmosphere. Instead, it forms by the reaction of ROG and NOx in the presence of sunlight and high temperatures. The sources of these pollutants, their effects on human health and the nation's welfare and their annual emission to the atmosphere, vary considerably.

Table 5-6 summarizes SJVAB attainment status with respect to the Federal and State ambient air quality standards. SJVAB is designated as an "extreme" nonattainment area for ozone NAAQS (for the 2008 8-hour ozone standard) and as nonattainment for PM2.5 NAAQS. SJVAB is a designated maintenance area for the CO NAAQS (CARB, 2013b).

Table 5-5: State and National Criteria Air Pollutant Standards, Effects and Sources

Pollutant	Averaging Time	State Standard	National Standard	Pollutant Health and Atmospheric Effects	Major Pollutant Sources
Ozone	1 hour	0.09 ppm	---	High concentrations can directly affect lungs, causing irritation. Long term exposure may cause damage to lung tissue.	Formed when reactive organic gases (ROG) and nitrogen oxides (NOx) react in the presence of sunlight. Major sources include on-road motor vehicles, solvent evaporation and commercial / industrial mobile equipment.
	8 hours	0.07 ppm	0.075 ppm		
Carbon Monoxide	1 hour	20 ppm	35 ppm	Classified as a chemical asphyxiant, carbon monoxide interferes with the transfer of fresh oxygen to the blood and deprives sensitive tissues of oxygen.	Internal combustion engines, primarily gasoline-powered motor vehicles.
	8 hours	9.0 ppm	9 ppm		
Nitrogen Dioxide	1 hour	0.18 ppm	100 ppb	Irritating to eyes and respiratory tract. Colors atmosphere reddish-brown.	Motor vehicles, petroleum refining operations, industrial sources, aircraft, ships and railroads.
	Annual Avg.	0.030 ppm	0.053 ppm		
Sulfur Dioxide	1 hour	0.25 ppm	75 ppb	Irritates upper respiratory tract; injurious to lung tissue. Can yellow the leaves of plants, destructive to marble, iron and steel. Limits visibility and reduces sunlight.	Fuel combustion, chemical plants, sulfur recovery plants and metal processing.
	3 hours	---	0.5 ppm		
	24 hours	0.04 ppm	0.14 ppm		
	Annual Avg.	---	0.030 ppm		
Respirable Particulate Matter (PM10)	24 hours	50 ug/m^3	150 ug/m^3	May irritate eyes and respiratory tract, decreases in lung capacity, cancer and increased mortality. Produces haze and limits visibility.	Dust and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions and natural activities (e.g., wind-raised dust and ocean sprays).
	Annual Avg.	20 ug/m^3	---		
Fine Particulate Matter (PM2.5)	24 hours	---	35 ug/m^3	Increases respiratory disease, lung damage, cancer and premature death. Reduces visibility and results in surface soiling.	Fuel combustion in motor vehicles, equipment and industrial sources; residential and agricultural burning; Also, formed from photochemical reactions of other pollutants, including NOx, sulfur oxides and organics.
	Annual Avg.	12 ug/m^3	12 ug/m^3		
Lead	Monthly Ave.	1.5 ug/m^3	---	Disturbs gastrointestinal system and causes anemia, kidney disease and neuromuscular and neurological dysfunction.	Present source: lead smelters, battery manufacturing & recycling facilities. Past source: combustion of leaded gasoline.
	Quarterly	---	1.5 ug/m^3		
Hydrogen Sulfide	1 hour	0.03 ppm	No National Standard	Nuisance odor (rotten egg smell), headache and breathing difficulties (higher concentrations)	Geothermal Power Plants, Petroleum Production and refining
Sulfates	24 hour	25 ug/m^3	No National Standard	Breathing difficulties, aggravates asthma, reduced visibility	Produced by the reaction in the air of SO_2.
Visibility Reducing Particles	8 hour	Extinction of 0.23/km; visibility of 10 miles or more	No National Standard	Reduces visibility, reduced airport safety, lower real estate value and discourages tourism.	PM2.5.

ppm = parts per million; ug/m^3 = micrograms per cubic meter.
SOURCE: California Air Resources Board, 2013a.; California Air Resources Board, 2009.

Table 5-6: San Joaquin Valley Attainment Status

Pollutant	Designation/Classification	
	Federal Standards	State Standards
Ozone – one hour	Nonattainment[1]	Nonattainment
Ozone – eight hour	Nonattainment/Extreme	Nonattainment
PM10	Attainment	Nonattainment
PM2.5	Nonattainment	Nonattainment
CO	Unclassified/Attainment	Attainment
Nitrogen Dioxide	Unclassified/Attainment	Attainment
Sulfur Dioxide	Unclassified	Attainment
Lead	Unclassified/Attainment	Attainment
Hydrogen Sulfide	No Federal Standard	Unclassified
Sulfates	No Federal Standard	Attainment
Visibility Reducing Particles	No Federal Standard	Unclassified

[1] Effective June 15, 2005, the U.S. EPA revoked the Federal 1-hour ozone standard, including associated designations and classifications. However, the SJVAPCD is mandated by the Federal CAA to develop a plan to meet the revoked standard. In 2013, SJVAPCD recorded no violations of the 1-hour ozone standard.
SOURCE: CARB 2013b.

Pursuant to CAA Section 176(c) requirements, USEPA promulgated the General Conformity Rule, which is used to determine if Federal actions meet the requirements of the CAA and the applicable SIPs by ensuring that pollutant emissions related to the action do not:

- Cause or contribute to new violations of a NAAQS.
- Increase the frequency or severity of any existing violation of a NAAQS.
- Delay timely attainment of a NAAQS or interim emission reduction.

A conformity determination under the General Conformity Rule is required if the Federal agency determines that:

- The action will occur in a nonattainment or maintenance area,
- One or more specific exemptions do not apply to the action,
- The action is not included in the Federal agency's "presumed to conform" list,
- The emissions from the project are not within the approved emissions budget for an applicable facility, and
- The total direct and indirect emissions of a pollutant (or its precursors) are at or above the *de minimis* levels established in the General Conformity regulations.

An action will be determined to conform to the applicable SIPs if the action meets the requirements of 40 CFR 93.158(c). The applicable general conformity thresholds that apply to all projects within SJVAPCD are as follows: 10 tons per year for ROG and NOx (ozone precursors), 100 tons per year for directly emitted PM2.5, 100 tons per year for CO and 100 tons per year for SO_2 (as a precursor to PM2.5).

State

The California Air Resources Board (CARB) is responsible for the development, implementation and enforcement of California's motor vehicle pollution control program, administration of the State's air

pollution research program, adoption and updating, as necessary, of CAAQS, review of local APCD activities and coordination of the development of the SIPs for achievement of the NAAQS.

CCAA establishes an air quality management process that generally parallels the Federal process. CCAA, however, focuses on attainment of CAAQS that, for certain pollutants and averaging periods, are more stringent than NAAQS. CAAQS are included in Table 5-5 along with NAAQS. Table 5-6 shows that the SJVAB, including San Joaquin County, are classified as nonattainment for the ozone, PM10 and PM2.5 CAAQS.

CCAA requires that air districts prepare a clean air plan or air quality attainment plan if the district violates CAAQS for CO, SO_2, NO_2 or ozone, showing strategies for and progress toward attaining CAAQS. These plans are updated triennially.

CCAA requires that CAAQS be met as expeditiously as practicable, but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve standards. The air quality attainment plan requirements established by CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind air pollution control districts are required to establish and implement emission control programs commensurate with the extent of pollutant transported to downwind districts. Air pollution problems in SJVAB are primarily the result of locally generated emissions. However, air pollution occasionally includes contributions from the San Francisco Bay Area or the Sacramento Valley.

Local

SJVAPCD is responsible for implementing Federal and State regulations at the local level, permitting stationary sources of air pollution and developing the local elements of SIPs. Emissions from indirect sources, such as automobile traffic associated with development projects, are addressed through APCD's air quality plans, which are each air quality district's contribution to the SIPs.

In addition, air quality management at the local level is also accomplished through SJVAPCD imposition of mitigation measures on project EIRs and mitigated negative declarations developed by project proponents under CEQA. Specific to project construction emissions, CEQA requires mitigation of air quality impacts that exceed certain significance thresholds set by the local air district. SJVAPCD's CEQA significance thresholds, which would be applicable to the project, are described below.

Greenhouse Gas Emissions

Federal

USEPA is responsible for GHG regulation at the Federal level. Key Federal GHG guidance and regulations relevant to the project are:

In *Massachusetts v. U.S. Environmental Protection Agency*, et al., 127 Sc.D. 1438 (2007), the U.S. Supreme Court ruled that GHGs fit within CAA's definition of a pollutant and that USEPA has the authority to regulate GHGs.

On December 7, 2009, the Final Endangerment and Cause or Contribute Findings for GHGs (endangerment finding) under Section 202(a) of the CAA, went into effect. The endangerment finding states that current and projected concentrations of the 6 key, well mixed GHGs in the atmosphere [carbon dioxide (CO2), methane (CH4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6) and other fluorinated gases including nitrogen trifluoride (NF3) and hydrofluorinated ethers (HFEs) threaten the health and welfare of current and future generations. Furthermore, it states that the combined emissions of these GHGs from new motor vehicles and their engines contribute to GHG pollution that threatens public health and welfare (USEPA 2012a).

Under the endangerment finding, USEPA is developing vehicle emission standards under CAA. USEPA and the Department of Transportation's National Highway Traffic Safety Administration issued a joint proposal to establish a program that includes standards that will reduce GHG emissions and improve fuel economy for light-duty vehicles in model years 2012 through 2016. This proposal marks the first GHG standards proposed by USEPA under the CAA as a result of the endangerment and cause or contribute findings (USEPA 2012b). These emission reductions were incorporated into the project analysis.

On February 18, 2010, the White House Council on Environmental Quality (CEQ) released draft guidance regarding the consideration of GHGs in NNEPA documents for Federal actions. On December 18, 2014, CEQ released revised draft guidance that describes how Federal departments and agencies should consider the effects of GHGs and climate change in their NEPA reviews. The revised draft guidance supersedes the draft GHG guidance released by CEQ in February 2010 and recommends that agencies consider 25,000 metric tons of carbon dioxide equivalent (CO2e) emissions from a proposed action to trigger a quantitative analysis. The revised draft guidance also emphasizes that agency analyses should be commensurate with projected GHG emissions and climate impacts (White House CEQ, 2014). Revised Draft Guidance for GHG Emissions and Climate Change Impacts. Available at:
https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance.

State

The CARB is responsible for the development, implementation and enforcement of California's motor vehicle pollution control program, GHG statewide emission estimates and goals, and development and enforcement of GHG emission reduction rules.

California is a substantial contributor of global GHGs as it is the second largest contributor in the U.S. and the sixteenth largest in the world (CEC 2006). From 1990 through 2003, California's gross State product grew 83 percent, while GHG emissions grew 12 percent. While California has a high amount of GHG emissions, it has low emissions per capita. The major source of GHG in California is transportation, contributing 41 percent of the State's total GHG emissions (CEC 2006). Electricity generation is the second largest generator, contributing 22 percent of the State's GHG emissions. Emissions from fuel use in the commercial and residential sectors decreased 9.7 percent over the 1990 to 2004 period (CEC 2006). California has taken proactive steps, briefly described in Table 5-7, to address the issues associated with GHG emissions and climate change.

California Environmental Quality Act GHG Amendments

CEQA and its Guidelines require that State and local agencies identify significant environmental impacts of their actions and to avoid or mitigate potentially significant impacts, when feasible. The CEQA amendments of December 30, 2009, specifically require lead agencies to address GHG emissions in determining the significance of environmental effects caused by a project and to consider feasible means to mitigate the significant effects of GHG emissions (California Natural Resources Agency 2010).

Relevant provisions of CEQA amendments include the following list. A lead agency subject to CEQA may consider the following when assessing the significance of impacts from GHG emissions:

1) The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting;

2) Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project;

3) The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional or local plan for the reduction or mitigation of GHGs.

When an agency makes a statement of overriding considerations, the agency may consider adverse environmental effects in the context of region-wide or statewide environmental benefits. Lead agencies shall consider feasible means of mitigating GHGs that may include, but not be limited to:

1) Measures in an existing plan or mitigation program for the reduction of emissions that are required as part of the lead agency's decision;

2) Reductions in emissions resulting from a project through implementation of project features, project design or other measures;

3) Off-site measures, including offsets;

4) Measures that sequester GHGs;

5) In the case of the adoption of a plan, such as a general plan, long-range development plan or GHG reduction plan, mitigation may include identification of specific measures that may be implemented on a project-by-project basis. Mitigation may also include the incorporation of specific measures or policies found in an adopted ordinance or regulation that reduces the cumulative effect of emissions.

Local

SJVAPCD is responsible for implementing Federal and State regulations at the local level. SJVAPCD developed guidance that San Joaquin Valley land use agencies can use to address GHG emission impacts for new projects under CEQA.

Table 5-7: Summary of Relevant California GHG Regulations

Bill, Year	Description
Assembly Bill (AB) 4420, 1988	Directed California Energy Commission, in consultation with the CARB and other agencies, to "study and report…on how global warming trends may affect California's energy supply and demand, economy, environment, agriculture and water supplies."
AB 1493, 2002	Requires CARB to develop and implement regulations to reduce automobile and light-truck GHG emissions. The stricter emissions standards apply to automobiles and light trucks beginning with the 2009 MY. Although litigation was filed challenging these regulations and EPA initially denied California's related request for a waiver, the waiver request has now been granted.
EO S-3-05, 2005	The goal of EO S-3-05 is to reduce California's GHG emissions to: (1) year 2000 levels by 2010, (2) 1990 levels by 2020 and (3) 80 percent below the 1990 levels by 2050.
AB 32, California Global Warming Solutions Act of 2006	Sets overall GHG emissions reduction goals and mandates that CARB create a plan that includes market mechanisms and implement rules to achieve "real, quantifiable, cost-effective reductions of GHGs." Requires statewide GHG emissions be reduced to 1990 levels by 2020. (The 1990 CO2e level is 427 million metric tons of CO2e (CARB 2011)). Directs CARB to develop and implement regulations to reduce statewide emissions from stationary sources. Specifies that regulations adopted in response to AB 1493 be used to address GHG emissions from vehicles. Requires CARB to adopt a quantified cap on GHG emissions representing 1990 emissions levels. Includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.
EO S-01-07, 2007	Requires the carbon intensity of California's transportation fuels to be reduced by at least 10 percent by 2020.
Senate Bill 97	This bill directed the Natural Resources Agency, in coordination with the Governor's Office of Planning Research, to address the issues through Amendments to the CEQA Guidelines. The revised Guidelines were adopted December 30, 2009 to provide direction to lead agencies about evaluating, quantifying and mitigating a project's potential GHG emissions.
Source: CARB 2012a, CARB 2012b, CARB 2012c	

Existing Conditions

Air Quality

The study area for the project is the San Joaquin County portion of the San Joaquin Valley Air Basin (SJVAB), which includes the 8 counties within the San Joaquin Valley.[2] SJVAPCD regulates air quality within the SJVAB. Approximately 250 miles long and 35 miles wide, SJVAB is a well-defined climatic region with distinct topographic features on 3 sides. The Coast Ranges, which have an average elevation of 3,000 feet, are located on the western border of SJVAB. The San Emigdio Mountains, which are part of the Coast Ranges and the Transverse Ranges, which are part of the Sierra Nevada, are both located on the south side of SJVAB. The Sierra Nevada forms the eastern border of SJVAB. No topographic feature delineates the northern edge of the basin.

[2] The SJVAB includes the following counties: San Joaquin, Stanislaus, Madera, Merced, Tulare, Kings, Fresno and the portion of Kern County west of the crest of the Sierra Nevada Mountains.

SJVAB is flat with a downward gradient to the northwest. Air flows into SJVAB through the Carquinez Strait, the only breach in the western mountain barrier, moves across the Delta from the San Francisco Bay area. The mountains surrounding SJVAB create a barrier to airflow that leads to entrapment of air pollutants when meteorological conditions are unfavorable for transport and dilution. As a result, SJVAB is highly susceptible to pollutant accumulation over time.

Summer is considered the ozone season in SJVAB, characterized by poor air movement in the mornings and longer daylight hours. Sunlight fuels photochemical reactions between reactive organic gases (ROG) and nitrogen oxides (NOx), resulting in ozone formation. Summer winds usually originate at the north end of the San Joaquin Valley and flow in a south-southwesterly direction through Tehachapi Pass and into the Southeast Desert Air Basin.

Criteria Pollutants

Criteria pollutants are the 6 air pollutants of primary concern to public health as established by the CAA. They include ozone, nitrogen dioxide, carbon monoxide (CO), particulate matter, sulfur oxides and lead. Of these 6, the pollutants of most concern for the project alternatives, which will result primarily from construction activities, are ozone precursors (consisting NOx and ROG), CO and particulate matter (PM10 and PM2.5). Within San Joaquin County, on-road motor vehicles are the major source of ROG, NOx and CO emissions. Other equipment and off-road vehicles contribute substantially to ROG, CO and NOx emissions. Fugitive dust, generated from construction, roadways and farming operations, is the major source of PM10 and, to a lesser degree, PM2.5. Fuel combustion also substantially contributes to PM2.5 emissions.

Table 5-8 shows recent monitoring data for ozone, PM10 and PM2.5. Monitoring data for CO and NO_2 are not shown, because there were no recorded violations of either CAAQS or NAAQS during the 2011-2013 period. Based on 2011-2013 data collected at the two monitoring stations located within San Joaquin County, ozone, PM10 and PM2.5 exceeded CAAQS and/or NAAQS.

Table 5-8: Air Quality Monitoring Data for San Joaquin County

Criteria Air Pollutant	NAAQS	CAAQS	Yearly Monitoring Data		
			2011	2012	2013
Stockton – Hazelton Street					
Ozone – 8-hour	0.075 ppm	0.07 ppm			
Highest concentration (ppm)			0.068	0.083	0.067
Days above CAAQS			0	6	0
Days above NAAQS			0	2	0
Tracy – Airport					
Ozone – 8-hour	0.075 ppm	0.07 ppm			
Highest concentration (ppm)			0.087	0.098	0.082
Days above CAAQS			21	36	5
Days above NAAQS			8	16	2
PM10 – Hazelton Street					
Highest 24-hour (μg/m^3)	150 μg/m^3	50 μg/m^3	70.1	70.0	95.5
Annual Arithmetic mean (μg/m^3)	N/A	20 μg/m^3	24.1	22.8	32.0
Days above CAAQS			24.4	17.9	58.2
Days above NAAQS			0.0	0.0	0.0
PM10 – Tracy Airport					
Highest 24-hour (μg/m^3)	150 μg/m^3	50 μg/m^3	110.8	73.4	73.2
Annual Arithmetic mean (μg/m^3)	N/A	20 μg/m^3	17.5	21.0	22.6
Days above CAAQS			N/A	N/A	N/A
Days above NAAQS			0.0	0.0	0.0
PM2.5 – Hazelton Street					
Highest 24-hour (μg/m^3)	35 μg/m^3	N/A	60.0	60.4	66.5
Annual Arithmetic mean (μg/m^3)	12.0 μg/m^3	12 μg/m^3	11.3	12.3	17.6
Days above CAAQS			N/A	N/A	N/A
Days above NAAQS			11	6	27.6

Notes:
ppm = parts per million
μg/m^3 = micrograms per cubic meter
Source: California Air Resources Board, 2014.

Toxic Air Contaminants

Toxic Air Contaminants (TAC) are defined by California law as an air pollutant that "may cause or contribute to an increase in mortality or an increase in serious illness or which may pose a present or potential hazard to human health." USEPA uses the term Hazardous Air Pollutant (HAPs) in a similar manner. Controlling toxic air emissions became a National priority with the passage of the Clean Air Act Amendments, whereby Congress mandated that USEPA regulate 188 air toxics. TACs can be emitted from stationary and mobile sources.

Ten TACs were identified through ambient air quality data as posing the greatest health risk in California. Direct exposure can cause cancer, birth defects, damage to the brain and nervous systems and respiratory disorders. TACs do not have ambient air quality standards because no safe levels were identified. Instead, TAC impacts are evaluated by calculating the health risks associated with a given exposure.

The TAC of interest to this project is Diesel Particulate Matter (DPM), primarily because of diesel powered construction equipment. DPM was identified by the California Office of Environmental Health Hazard Assessment (OEHHA) as a carcinogen and as a chronic health risk (California OEHHA, 2013).

Odors

Odors are typically associated with specific types of industrial sources such as wastewater treatment plants, chemical manufacturing, refineries and rendering plants. Odors associated with construction projects such as levee construction and maintenance typically do not constitute significant odor sources.

Sensitive Receptors

Some locations are considered more sensitive to adverse effects from air pollution than others. A sensitive receptor is generally defined as a location where human populations, especially children, seniors and sick persons are found and where there is a reasonable expectation of continuous human exposure according to appropriate standards (e.g., 24-hour, 8-hour and 1-hour). Sensitive land uses and sensitive receptors generally include residents, medical facilities, schools and day care facilities.

Climate Change

Warming of the earth's climate is now considered to be unequivocal (IPCC, 2007). Global average surface temperature increased approximately 1.33 °F over the last 100 years, with the most severe warming occurring in the most recent decades. In the 12 years between 1995 and 2006, 11 years ranked among the warmest in the record of global average surface temperature (going back to 1850). Continued warming is projected to increase global average temperature between 2 and 11 °F over the next 100 years (IPCC, 2007). The causes of this are both natural processes and the result of human actions. Increases in GHG concentrations in the Earth's atmosphere are thought to be the main cause of human induced climate change.

Some GHGs, such as CO2, are emitted to the atmosphere by natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. Each GHG traps a different amount of heat. In order to compare emissions of different GHGs, a weighting factor called a Global Warming Potential (GWP) is used. Emissions are expressed in terms of CO2e. Therefore, the GWP of CO2 is 1; the GWP of methane (CH_4) is 21; and the GWP of nitrous oxide (N_2O) is 310. These 3 GHGs are evaluated for this project, because they would be emitted during construction activities, primarily as a by-product of fuel combustion.

Statewide GHG emissions in 2008 were 427 million metric tons of CO2e. Based on this estimate, statewide emissions would need to be reduced by 16 percent from existing levels to meet the AB 32 goal of achieving 1990 CO2e levels (427 million metric tons of CO2e) (CARB, 2011).

5.8.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

This section describes the air quality and GHG significance thresholds, explains the methodology used to evaluate significance.

Assessment Methods

Criteria Pollutants

Emissions were calculated using the Road Construction Emission Model (RCEM), used to estimate emissions from linear construction projects. RCEM uses the CARB OFFROAD 2011 and EMFAC2011 emission factors.[3] The worksheet estimates emissions for both vehicle exhaust and fugitive dust. The methodology used to estimate fugitive dust emissions involves estimates of the maximum area (acreage) of land disturbed daily.

The RCEM software calculates a project's emissions in pounds per day (and kilograms per day) by project phase and metric tons over the entire construction period.

For each project alternative, emissions were estimated using RCEM for each year of construction and for each phase within each year. The phases included:

1) Grubbing /land clearing,
2) Tree removal,
3) Stripping to spoil
4) Excavation to stockpile
5) Excavation to spoil
6) Cutoff wall conventional
7) Cutoff wall deep soil mixing
8) Cohesive fill
9) Random fill
10) Road – Place and fine grade
11) Revegetation/Seeding
12) Rip/Rap placement

[3] RCEM (Road Construction Emissions Model) is used to estimate construction emissions from linear projects such as roadways, bridges, utility work and levee repair (SMAQMD, 2013).

The length of each phase and the construction equipment used with each phase was based on information developed by USACE (Elsberry, J., 2014).

Toxic Air Contaminants

Toxic air contaminants were evaluated qualitatively by examining the likelihood that each alternative would cause significant health risks to nearby sensitive receptors.

Odors

Odors were evaluated qualitatively by the likelihood that each alternative would create significant odor impacts to nearby sensitive receptors.

GHG Emissions

Since RCEM estimates CO_2 emissions but not CO_2e emissions, CO_2 emissions estimates were increased by 5 percent to represent total CO_2e emissions[1].

Basis of Significance

Air Quality Significance Thresholds

According to CEQA Guidelines, a significant impact would occur with respect to air quality if the project would:

- Result in a cumulatively considerable net increase of any criteria air pollutant for which the region is in nonattainment;
- Conflict with or obstruct implementation of the applicable air quality plan;
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

Criteria Pollutants

Due to the general nature of the 4 significance thresholds listed above, SJVAPCD developed quantitative criteria to evaluate the significance of air emissions under CEQA. Specifically, a significant impact would occur if implementation of a project alternative would result in emissions that exceed thresholds established by SJVAPCD. Thresholds for a project are:

- NOx: 10 tons per year
- ROG: 10 tons per year
- PM10: 15 tons per year
- PM2.5: 15 tons per year
- SO_2: 27 tons per year (SJVAPCD, 2012)

SJVAPCD's CEQA thresholds represent the emission levels that would result in a direct and/or indirect project impact, as well as impacts resulting in a cumulatively considerable net increase in pollutants. SJVAPCD applies the CEQA thresholds listed above separately to 3 emission categories: 1) construction emissions, 2) operational non-exempt equipment emissions and 3) operational exempt emissions.

[1] CO_2e emissions from construction equipment typically are no more than 5 percent greater than CO_2 emissions.

The second category – operational non-exempt emissions, includes emissions from any operational source subject to stationary source air permitting. The third category – operational exempt emissions – includes emissions from all operational sources that are exempt from stationary source air permitting, including both stationary and mobile sources (SJVAPCD, 2012).

The General Conformity Rule (GCR) requires that the responsible Federal agency review any action to determine if it would be likely to cause or contribute to a violation of NAAQS or delay timely attainment of any NAAQS or any interim emission reduction required by the applicable SIPs or any other Federally identified air quality milestones. The first step in the conformity process is to evaluate whether the action would produce emissions above the GCR *de minimis* thresholds applicable to the specific area, thus requiring a detailed air quality conformity analysis.

The GCR de minimis levels are based on the nonattainment classification of the local air basin. The project alternatives are located in SJVAB, an ozone nonattainment area classified as "extreme." SJVAB is also classified as nonattainment for PM2.5 and was recently classified as a maintenance area for PM10. The applicable GCR de minimis thresholds for the project alternatives are:

- NOx: 10 tons per year
- ROG: 10 tons per year
- PM10: 100 tons per year
- PM2.5: 100 tons per year
- SO_2: 100 tons per year (as a precursor to PM2.5)

The GCR *de minimis* thresholds are applied to combined construction and operational emissions occurring each year. If a project's combined emissions are below the *de minimis* levels, the Federal action agency is not required to make a general conformity determination and the action would be considered to conform to the SIPs (40 Code of Federal Regulations [CFR] 93 § 153). The GCR *de minimis* levels are typically used to determine the potential significance of an impact under NEPA and are used to evaluate significance for this Project.

Toxic Air Contaminants

The project alternatives would emit DPM from heavy-duty trucks and emergency diesel generators. DPM is considered a TAC that can increase both carcinogenic and chronic health risks (California OEHHA, 2013). A project is considered to have a significant TAC impact if it would:

- Result in ground level concentrations of carcinogenic TACs that would increase the probability of contracting cancer for the maximally exposed individual by 10 in 1 million or more or;
- Increase ground level concentrations of non-carcinogenic TACs that would result in a hazard index exceeding 1 for the maximally exposed individual.

The TAC analysis evaluates potential DPM impacts associated with construction and operations. These thresholds are used to evaluate significance for both CEQA and NEPA.

Odors

SJVAPCD's CEQA guidance defines a significant odor impact as one that:

- Creates objectionable odors affecting a substantial number of people.

SJVAPCD's guidance lists facility types that commonly produce odors and the separation distance from sensitive receptors (typically 1 mile) needed to prevent significant odor impacts (SJVAPCD, 2012). The

list of facility types is not meant to be all-inclusive. Consequently, SJVAPCD recommends that all potential odor sources be evaluated in additional detail if they are located within 1 mile of sensitive receptors. This approach is used to evaluate odor impacts for the project alternatives for both CEQA and NEPA.

GHG Significance Thresholds

According to CEQA Guidelines, a significant GHG impact would occur if an action would:

- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment;
- Conflict with an applicable plan, policy or regulation adopted for reducing the emissions of GHGs.

The SJVAPCD recommends a 29 percent reduction in GHG emissions be used to evaluate a project's CEQA significance. This percentage is based on a project's actual mitigated emissions when compared to business as usual emissions that do not account for mitigation or rules and regulations enacted to comply with AB 32. SJVAPCD's approach to estimating percentage reduction was recently invalidated by the California Supreme Court (CBD v. CDFW and Newhall Land and Farming Company, S217763) because it used the statewide average percentage reduction of 29% instead of a percentage calculated specifically for the San Joaquin Valley Air Basin. Consequently, for CEQA, the project's GHG emissions are evaluated based on consistency with the two CEQA significance guidelines listed above.

Draft NEPA GHG guidance states that emissions greater than the 25,000 metric tons of CO_2e[2] per year should be the threshold at which GHG emissions are quantified. However, 25,000 metric tons of CO_2e is not a significance threshold, it is only the threshold at which GHG emissions are recommended to be quantified (White House Council on Environmental Quality, 2010). For the purposes of this analysis, 25,000 metric tons CO_2e per year is used as the significance threshold for NEPA.

Effects and Mitigation Measures

5.8.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, no construction would occur and no GHG emissions would result. In addition, existing levels of operational GHG emissions from maintenance activities would not change. However, without added flood control measures, there would be a greater likelihood of future flooding and associated property damage (California DWR, 2012). Consequently, although there would be no direct increase in GHG emissions associated with the No Action Alternative, there would be a higher likelihood of future flooding. The increased probability of future flooding could result in GHG emissions from emergency response to such events and the resulting emissions associated with rebuilding. However, developing accurate scenarios needed to estimate GHG emissions is speculative at best. Therefore, the impact of the No Action Alternative is considered **too speculative for meaningful consideration.**

5.8.4 ALTERNATIVE 7A

Table 5-9 summarizes Alternative 7a's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 7a would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2023. From 2024 through 2029, the project's NOx emissions would be less than the respective thresholds.

[2] CO_2e = carbon dioxide equivalent. CO_2e is a metric measure used to compare the emissions from various GHGs based upon their GWP, using carbon dioxide as the reference gas (i.e., GWP of CO_2 is 1).

Annual emissions decrease over time because construction activity levels drop and the construction fleet generates lower average emissions over time as older equipment generating high levels of emissions is replaced by newer, lower-emitting equipment. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions during the 2019 through 2023 period would still exceed SJVAPCD significance thresholds and Federal conformity thresholds, and would therefore contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.5 ALTERNATIVE 7B

Table 5-13 summarizes Alternative 7b's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 7b would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2024. From 2025 through 2031, the project's NOx emissions would be equal to or less than the respective thresholds. Annual emissions decrease because the construction fleet generates lower emissions over time as older equipment generating high levels of emissions is replaced by newer, lower-emitting equipment. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions during the 2019 through 2024 period would still exceed SJVAPCD significance thresholds and Federal conformity thresholds and would therefore contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.6 ALTERNATIVE 8A

Table 5-17 summarizes Alternative 8a's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 8a would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2024. From 2025 through 2029, the project's NOx emissions would be less than the respective thresholds.

Annual emissions decrease because the construction fleet generates lower emissions over time as older equipment generating high levels of emissions is replaced by newer, lower-emitting equipment. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions during the 2019 through 2024 period would still exceed SJVAPCD significance thresholds and Federal conformity thresholds and would therefore contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.7 ALTERNATIVE 8B

Table 5-21 summarizes Alternative 8b's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 8b would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2028. From 2029 through 2031, the project's NOx emissions would be less than the respective thresholds. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions from 2019 through 2028 would still exceed SJVAPCD significance thresholds and Federal conformity thresholds and would therefore contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.8 ALTERNATIVE 9A

Table 5-25 summarizes Alternative 9a's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 9a would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2023. From 2024 through 2029, the project's NOx emissions would be less than the respective thresholds. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions during the 2019 through 2023 period would still exceed SJVAPCD significance thresholds and Federal conformity thresholds and would, therefore, contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.9 ALTERNATIVE 9B

Table 5-29 summarizes Alternative 9b's construction emissions. Emissions would be below the SJVAPCD and Federal conformity thresholds for all pollutants except NOx. For NOx, Alternative 9b would generate emissions exceeding SJVAPCD's CEQA thresholds and Federal conformity thresholds from 2019 through 2024. From 2025 through 2031, the project's NOx emissions would be less than the respective thresholds. Construction-related NOx emissions would likely be offset by future reductions in NOx emissions resulting from flood avoidance. However, NOx emissions during the 2019 through 2024 period would still exceed SJVAPCD significance thresholds and Federal conformity thresholds and would, therefore, contribute to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the project's NOx emissions are **significant**.

5.8.10 MITIGATION

Alternative 7a Mitigation

The emissions shown in Table 5-9 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The following measures focus on reducing NOx emissions. The Lead Agency shall either:

- Require the use of off-road equipment that meets or exceeds USEPA or California Air Resources Board CARB Tier 3 off-road emission standards for all off-road vehicles greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor(s) shall prepare and submit a Construction Emissions Minimization Plan (Plan) to the Lead Agency for review and approval. The Plan shall include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. Equipment descriptions and information shall include: equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number and expected fuel usage and hours of operation. The Plan shall be kept by the Lead Agency and made available for review by any persons requesting it. Quarterly reports shall be submitted by the prime contractor(s) to the Lead Agency indicating the construction phase and equipment information used during each phase for the previous quarter;

<u>or</u>

- Enter into a Verified Emission Reduction Agreement (VERA) with SJVAPCD. The VERA would require payment of a fee to SJVAPCD that would be used to purchase NOx emission reductions to offset all NOx emissions during years when the Project's unmitigated NOx emissions exceed 10 tons. The VERA will be entered into prior to initiating the project and posted on the Lead Agency's website. The NOx offsets developed by the fee will be provided to the Lead Agency and posted on the Lead Agency's website. The information shall be posted in a location that is easy to access by the public and must remain on the website for 1 full year after all construction is completed.

Implementation of either measure listed above will reduce NOx emissions during construction. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5. However, those emission reductions are not shown in Table 5-10, because the unmitigated emissions of these other pollutants (Table 5-9) are below State and Federal significance thresholds.

Table 5-9: Alternative 7a Annual Construction Emissions

Calendar Year	ROG (tons/ yr)	CO (tons/yr)	NOx (tons/ yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/ yr)	CO_2e (metric tons/yr)
2019	1.3	8.8	17.7	0.3	6.7	1.9	3,661
2020	1.2	.8	15.3	0.3	6.7	1.8	3,614
2021	1.1	8.9	12.0	0.3	6.6	1.8	3,606
2022	1.7	16.5	14.6	0.3	5.7	1.7	5,132
2023	1.4	14.1	11.6	0.3	5.4	1.5	3,535
2024	0.7	8.2	5.3	0.2	4.7	1.1	1,759
2025	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2026	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2027	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2028	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2029	0.6	7.9	4.7	0.2	3.5	0.9	1,605
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2023	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2023	No	No	No	No

SO_2 emissions not estimated by RCEM. However, SO_2 typically less than 5 percent of PM10 exhaust. Consequently, SO_2 conservatively assumed to equal 5 percent of PM10. RECM does not estimate emissions after 2025. Therefore, the values shown for 2025 through 2031 are based on 2025 emission factors. Actual emissions would be slightly lower than those shown.

Table 5-10: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent
NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.	

Table 5-11 shows that mitigating NOx emissions using Tier 3 vehicles would reduce emissions to below 10 tons per year during all years of construction.

Table 5-11: Alternative 7a Mitigated NOx emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.1	2023	7.5
2020	7.7	2024	3.8
2021	6.7	2025-2029	3.9
2022	8.7		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2023. Table 5-12 shows the estimated cost of entering into a VERA to offset the 71.2 tons of NOx that would be emitted by Alternative 7a between 2019 and 2023, which are the years when NOx would exceed the Federal NOx conformity threshold.

Table 5-12: Alternative 7a Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	71.2
Estimated Mitigation Fee (per ton)	$ 9,350
Total Cost	$ 665,720
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510. First row shows total NOx emissions for each year when emissions exceed 10 tons.	

With implementation of either measure, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant**.

Impact

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. According to OEHHA, health risk assessments should be based on a 70-year exposure period. However, such assessments should be limited to the period of the activities associated with a project.

The length of time that off-road equipment would operate near sensitive receptors would be relatively short. As levee work is completed, equipment typically would progress along the levee alignments and would not operate within 500 feet of any one receptor for more than a few weeks at a time. Receptors located within 500 feet of borrow areas could be exposed for longer periods. The program's overall construction emissions would not be concentrated in 1 particular area and would not result in an additive exposure mechanism.

Because the exposure period for receptors near construction areas would be substantially less than the required exposure period for health risk assessments (i.e., 70 years) and since construction emissions would be spread over a large geographical area, health risks were evaluated qualitatively. For these reasons, it is unlikely that construction activities would expose sensitive receptors to substantial DPM concentrations. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, several pieces of construction equipment would need to operate concurrently in a relatively small area to generate a constant plume of diesel exhaust that would cause objectionable odors for a substantial number of people. These circumstances would not occur as part of the project. Construction activities would move on a regular basis, which is typical of linear construction projects. This movement minimizes the potential for a substantial exposure to objectionable odors. Since construction activities would not generate odors that would affect a substantial number of people, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction is completed. Such activities occur periodically now and future increases in maintenance activities are expected to be minor. Operational maintenance activities would occur at a low frequency and intensity and would not generate substantial direct emissions of criteria pollutants, toxic air contaminants or odors. Because maintenance activities would result in only a minimal increase in operational emissions relative to existing conditions, such activities would not exceed SJVAPCD's significance thresholds. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. GHGs emitted during near-term construction would not be immediately offset by GHG emissions avoided through flood-protection, although the mitigation measures specified for 7A_AQ-1 will also reduce GHG emissions. In addition and consistent with DWR BMPs, the following measures should be implemented to reduce GHG emissions (California DWR, 2012):

- Avoid tillage and maintain vegetation on levees and other properties to the extent possible to maximize carbon sequestration.
- At construction sites, seed or plant native grasses and wildflowers in disturbed areas where feasible since those species are best adapted to local conditions and will often require minimal maintenance once established.
- Reduce vegetation manipulation (mowing or spraying herbicides) when possible while maintaining proper function of the levee or property for its intended purpose. Mow vegetation if necessary rather than applying herbicides. If mowing is conducted, use fuel efficient mowers in proper working condition and minimize idling time by requiring that equipment be shut down after five minutes when not in use.
- Carefully plan and schedule vegetation maintenance activities to minimize driving time and return trips to a site.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing flood protection would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities. Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-9).
- Implementation would reduce flood risks and therefore would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 7a's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be **less than significant**.

Mitigation

No mitigation is required.

Alternative 7b Mitigation

The emissions shown in Table 5-13 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The same measures to reduce NOx emissions would be implemented as described for Alternative 7a.

Implementation of either measure will reduce NOx emissions during construction. The use of Tier 3 off-road vehicles will result in emission reductions as shown in Table 5-14. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5. However, those emission reductions are not shown in Table 5-15 because the unmitigated emissions of these other pollutants (Table 5-13) are below State and Federal significance thresholds.

Table 5-13: Alternative 7b Annual Construction Emissions

Calendar Year	ROG (tons/yr)	CO (tons/yr)	NOx (tons/yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/yr)	CO_2e (metric tons/yr)
2019	1.5	10.1	19.1	0.4	7.2	2.0	4,461
2020	1.4	10.1	16.7	0.4	7.1	2.0	4,415
2021	1.3	10.2	13.4	0.4	7.1	1.9	4,407
2022	1.9	18.0	16.3	0.4	7.5	2.1	5,986
2023	1.8	17.9	14.9	0.4	7.4	2.1	5,978
2024	1.7	17.9	13.9	0.4	7.4	2.0	5,981
2025	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2026	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2027	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2028	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2029	0.6	5.9	5.0	0.3	5.3	1.3	1,812
2030	0.4	4.3	3.3	0.3	5.8	1.3	1,021
2031	0.4	4.0	3.0	0.2	4.7	1.1	857
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2028	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2028	No	No	No	No

SO_2 emissions not estimated by RCEM. However, SO_2 typically less than 5 percent of PM10 exhaust. Consequently, SO_2 conservatively assumed to equal 5 percent of PM10. RECM does not estimate emissions after 2025. Therefore, the values shown for 2025 through 2031 are based on 2025 emission factors. Actual emissions would be slightly lower than those shown.

Table 5-14: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent

NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.

Table 5-15 shows that mitigating NOx emissions using Tier 3 vehicles would reduce emissions to below 10 tons per year during all years of construction.

Table 5-15: Alternative 7b Mitigated NOx Emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.8	2026	8.2
2020	8.4	2027	8.2
2021	7.5	2028	8.2
2022	9.7	2029	4.1
2023	9.7	2030	3.3
2024	9.8	2031	3.0
2025	8.2		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2024. Table 5-16 shows the estimated cost of entering into a VERA to offset the 94.3 tons of NOx that would be emitted by Alternative 7b between 2019 and 2024.

Table 5-16: Alternative 7b Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	94.3
Estimated Mitigation Fee (per ton)	$ 9,350
Total Cost	$ 882,164
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510. First row shows total NOx emissions for each year when emissions exceed 10 tons.	

With implementation of either measure, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant**.

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. The potential impacts of exposure to TACs is the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, the potential impact is the same as Alternative 7a. Therefore, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction is complete. Such maintenance activities would be the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during in-place levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. The mitigation measures for 7B_AQ-1 would be the same as Alternative 7a.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing flood protection would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities.

Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-9).
- Implementation would reduce flood risks and, therefore, would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 7b's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be **less than significant**.

Mitigation

No mitigation is required.

Alternative 8a Mitigation

The emissions shown in Table 5-17 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The following measures focus on reducing NOx emissions. The Lead Agency shall either:

- Require the use of off-road equipment that meets or exceeds USEPA or CARB Tier 3 off-road emission standards for all off-road vehicles greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor(s) shall prepare and submit a Construction Emissions Minimization Plan (Plan) to the Lead Agency for review and approval. The Plan shall include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. Equipment descriptions and information shall include: equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number and expected fuel usage and hours of operation. The Plan shall be kept by the Lead Agency and made available for review by any persons requesting it. Quarterly reports shall be submitted by the prime contractor(s) to the Lead Agency indicating the construction phase and equipment information used during each phase for the previous quarter;

or

- Enter into a VERA with SJVAPCD. The VERA would require payment of a fee to SJVAPCD that would be used to purchase NOx emission reductions to offset all NOx emissions during years when the Project's unmitigated NOx emissions exceed ten tons. The VERA will be entered into prior to initiating the project and posted on Lead Agency website. The NOx offsets developed by the fee will be provided to the Lead Agency and also posted on the Lead Agency's website. The information posted shall be posted in a location that is easy to access by the public and must remain on the website for one full year after all construction is completed.

Implementation of either measure listed above will reduce NOx emissions during construction. The use of Tier 3 off-road vehicles will result in emission reductions as shown in Table 5-18. The emission reductions decrease over time because Tier 3 only vehicles are being compared to the average construction fleet and that fleet gets cleaner over time as older vehicles are replaced by newer, lower emitting equipment. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5.

Table 5-17: Alternative 8a Annual Construction Emissions

Calendar Year	ROG (tons/yr)	CO (tons/yr)	NOx (tons/yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/yr)	CO2e (metric tons/yr)
2019	1.5	10.1	19.1	0.4	7.2	2.0	4,461
2020	1.4	10.1	16.7	0.4	7.1	2.0	4,414
2021	1.3	10.2	13.4	0.4	7.1	1.9	4,407
2022	1.9	17.8	16.0	0.3	6.1	1.8	5,932
2023	1.8	17.7	14.6	0.3	6.0	1.8	5,924
2024	1.3	14.1	10.8	0.3	5.4	1.5	3,536
2025	0.8	9.2	6.1	0.2	4.0	1.0	2,405
2026	0.8	9.2	6.1	0.2	4.0	1.0	2,405
2027	0.8	9.2	6.1	0.2	4.0	1.0	2,405
2028	0.8	9.2	6.1	0.2	4.0	1.0	2,405
2029	0.8	9.2	6.1	0.2	4.0	1.0	2,405
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2024	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2024	No	No	No	No

Table 5-18: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent
NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.	

Table 5-19 shows mitigating NOx emissions using Tier 3 vehicles. This mitigation would reduce emissions to below 10 tons per year during all years of construction.

Table 5-19: Alternative 8a Mitigated NOx emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.8	2025	5.0
2020	8.4	2026	5.0
2021	7.5	2027	5.0
2022	9.6	2028	5.0
2023	9.5	2029	5.0
2024	7.6		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2024. Table 5-20 shows the estimated cost of entering into a VERA to offset the 90.7 tons of NOx that would be emitted by Alternative 8a between 2019 and 2024.

Table 5-20: Alternative 8a Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	90.7
Estimated Mitigation Fee (per ton)	$ 9,350
Total Cost	$ 848,045
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510. First row shows total NOx emissions for each year when emissions exceed 10 tons. First row shows total NOx emissions for each year when emissions exceed 10 tons.	

With implementation of either measure, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. The potential impacts of exposure to TACs is the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, the potential impact is the same as Alternative 7a. Therefore, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction is complete. Such maintenance activities would be the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during in-place levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. The mitigation measures for 8A_AQ-1 would be the same as Alternative 7a.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing FRM would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities.

Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-13).
- Implementation would reduce flood risks and therefore would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 8a's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be **less than significant**.

Mitigation

No mitigation is required.

Alternative 8b Mitigation

The emissions shown in Table 5-21 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The following measures focus on reducing NOx emissions. The Lead Agency shall either:

- Require the use of off-road equipment that meets or exceeds USEPA or CARB Tier 3 off-road emission standards for all off-road vehicles greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor(s) shall prepare and submit a Construction Emissions Minimization Plan (Plan) to the Lead Agency for review and approval. The Plan shall include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. Equipment descriptions and information shall include: equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number and expected fuel usage and hours of operation. The Plan shall be kept by the Lead Agency and made available for review by any persons requesting it. Quarterly reports shall be submitted by the prime contractor(s) to the Lead Agency indicating the construction phase and equipment information used during each phase for the previous quarter;

<u>or</u>

- Enter into a VERA with SJVAPCD. The VERA would require payment of a fee to SJVAPCD that would be used to purchase NOx emission reductions that would offset all NOx emissions during years when the Project's unmitigated NOx emissions exceed ten tons. The VERA will be entered into prior to initiating the project and posted on Lead Agency website. The NOx offsets developed by the fee will be provided to the Lead Agency and also posted on the Lead Agency's website. The information shall be posted in a location that is easy to access by the public and must remain on the website for 1 full year after all construction is complete.

Implementation of either measure listed above will reduce NOx emissions during construction. The use of Tier 3 off-road vehicles will result in emission reductions as shown in Table 5-22. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5.

Table 5-21: Alternative 8b Annual Construction Emissions

Calendar Year	ROG (tons/yr)	CO (tons/yr)	NOx (tons/yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/yr)	CO2e (metric tons/yr)
2019	1.5	10.1	19.1	0.4	7.2	2.0	4,461
2020	1.4	10.1	16.7	0.4	7.1	2.0	4,415
2021	1.3	10.2	13.4	0.4	7.1	1.9	4,407
2022	1.9	18.0	16.3	0.4	7.5	2.1	5,986
2023	1.8	17.9	14.9	0.4	7.4	2.1	5,978
2024	1.7	17.9	13.9	0.4	7.4	2.0	5,981
2025	1.3	14.0	10.2	0.4	7.2	1.8	5,134
2026	1.3	14.0	10.2	0.4	7.2	1.8	5,134
2027	1.3	14.0	10.2	0.4	7.2	1.8	5,134
2028	1.3	14.0	10.2	0.4	7.2	1.8	5,134
2029	0.7	6.5	5.5	0.3	6.3	1.5	2,007
2030	0.7	6.5	5.5	0.3	6.3	1.5	2,007
2031	0.7	6.5	5.5	0.3	6.3	1.5	2,007
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2028	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2028	No	No	No	No

Table 5-22: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent
NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.	

Table 5-23 shows the results of mitigating NOx emissions using Tier 3 vehicles. This mitigation would reduce emissions to below 10 tons per year during all years of construction.

Table 5-23: Alternative 8b Mitigated NOx Emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.8	2026	8.4
2020	8.4	2027	8.4
2021	7.5	2028	8.4
2022	9.7	2029	4.5
2023	9.7	2030	4.5
2024	9.8	2031	4.5
2025	8.4		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2028. Table 5-24 shows the estimated cost of entering into a VERA to offset the 135.0 tons of NOx that would be emitted by Alternative 8b between 2019 and 2024.

Table 5-24: Alternative 8b Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	135.0
Estimated Mitigation Fee (per ton)	$ 9,350.00
Total Cost	$ 1,262,250
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510. First row shows total NOx emissions for each year when emissions exceed 10 tons. First row shows total NOx emissions for each year when emissions exceed 10 tons.	

With implementation of either measure, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant.**

Mitigation

No mitigation is required.

Impact

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. The potential impacts of exposure to TACs are the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, the potential impact is the same as Alternative 7a. Therefore, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction has been completed. Such maintenance activities would be the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during in-place levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. The mitigation measures for 8B_AQ-1 would be the same as Alternative 7a.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood-risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing flood protection would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities.

Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-21).
- Implementation would reduce flood risks and therefore would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 8b's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be **less than significant**.

Mitigation

No mitigation is required.

Alternative 9a Mitigation

The emissions shown in Table 5-25 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The following measures focus on reducing NOx emissions. The Lead Agency shall either:

- Require the use of off-road equipment that meets or exceeds USEPA or CARB Tier 3 off-road emission standards for all off-road vehicles greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor(s) shall prepare and submit a Construction Emissions Minimization Plan (Plan) to the Lead Agency for review and approval. The Plan shall include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. Equipment descriptions and information shall include: equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number and expected fuel usage and hours of operation. The Plan shall be kept by the Lead Agency and made available for review by any persons requesting it. Quarterly reports shall be submitted by the prime contractor(s) to the Lead Agency indicating the construction phase and equipment information used during each phase for the previous quarter;

<u>or</u>

- Enter into a VERA with SJVAPCD. The VERA would require payment of a fee to SJVAPCD that would be used to purchase NOx emission reductions that would offset all NOx emissions during years when the Project's unmitigated NOx emissions exceed ten tons. The VERA will be entered into prior to initiating the project and posted on the Lead Agency website. The NOx offsets developed by the fee will be provided to the Lead Agency and also posted on the Lead Agency's website. The information shall be posted in a location that is easy to access by the public and must remain on the website for 1 full year after all construction is complete.

Implementation of either measure listed above will reduce NOx emissions during construction. The use of Tier 3 off-road vehicles will result in emission reductions as shown in Table 5-26. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5.

Table 5-25: Alternative 9a Annual Construction Emissions

Calendar Year	ROG (tons/yr)	CO (tons/yr)	NOx (tons/yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/yr)	CO_2e (metric tons/yr)
2019	1.3	8.8	17.7	0.3	6.7	1.9	3,661
2020	1.2	8.8	15.3	0.3	6.7	1.8	3,614
2021	1.1	8.9	12.0	0.3	6.6	1.8	3,606
2022	1.7	16.5	14.6	0.3	5.7	1.7	5,132
2023	1.4	14.1	11.6	0.3	5.4	1.5	3,535
2024	0.7	8.2	5.3	0.2	4.7	1.1	1,759
2025	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2026	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2027	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2028	0.6	7.9	4.7	0.2	3.5	0.9	1,605
2029	0.6	7.9	4.7	0.2	3.5	0.9	1,605
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2023	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2023	No	No	No	No

Table 5-26: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent
NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.	

Table 5-27shows the resulting mitigated NOx emissions using Tier 3 vehicles. This mitigation would reduce emissions to below 10 tons per year during all years of construction.

Table 5-27: Alternative 9a Mitigated NOx Emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.1	2025	3.9
2020	7.7	2026	3.9
2021	6.7	2027	3.9
2022	8.7	2028	3.9
2023	7.5	2029	3.9
2024	3.8		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2023. Table 5-28 shows the estimated cost of entering into a VERA to offset the 71.2 tons of NOx that would be emitted by Alternative 9a between 2019 and 2024.

Table 5-28: Alternative 9a Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	71.2
Estimated Mitigation Fee (per ton)	$ 9,350
Total Cost	$ 665,720
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510. First row shows total NOx emissions for each year when emissions exceed 10 tons.	

With implementation of either option, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. The potential impacts of exposure to TACs is the same as in Alternative 7a. Therefore, this impact would be less than significant.

Mitigation

No mitigation is required.

Impact

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, the potential impact is the same as Alternative 7a. Therefore, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction is complete. Such maintenance activities would be the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during in-place levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. The mitigation measures for 9A_AQ-1 would be the same as Alternative 7a.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood-risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing flood protection would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities.

Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-25).
- Implementation would reduce flood risks and, therefore, would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 9a's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be **less than significant**.

Mitigation

No mitigation is required.

Alternative 9b Mitigation

The emissions shown in Table 5-29 already account for fugitive dust reductions required by SJVAPCD Regulation VIII - Fugitive PM10 Prohibitions. Since emissions of both PM10 and PM2.5 are less than the significance thresholds, no additional measures are proposed. The following measures focus on reducing NOx emissions. The Lead Agency shall either:

- Require the use of off-road equipment that meets or exceeds USEPA or CARB Tier 3 off-road emission standards for all off-road vehicles greater than 25 horsepower and operating for more than 20 total hours over the entire duration of construction activities. Prior to issuance of a construction permit, the prime contractor(s) shall prepare and submit a Construction Emissions Minimization Plan (Plan) to the Lead Agency for review and approval. The Plan shall include estimates of the construction timeline by phase with a description of each piece of equipment required for every construction phase. Equipment descriptions and information shall include: equipment type, equipment manufacturer, equipment identification number, engine model year, engine certification (Tier rating), horsepower, engine serial number and expected fuel usage and hours of operation. The Plan shall be kept by the Lead Agency and be available for review by any persons requesting it. Quarterly reports shall be submitted by the prime contractor(s) to the Lead Agency indicating the construction phase and equipment information used during each phase for the previous quarter;

or

- Enter into a VERA with SJVAPCD. The VERA would require payment of a fee to SJVAPCD that would be used to purchase NOx emission reductions that would offset all NOx emissions during years when the Project's unmitigated NOx emissions exceed ten tons. The VERA will be entered into prior to initiating the project and posted on Lead Agency website. The NOx offsets developed by the fee will be provided to the Lead Agency and also posted on the Lead Agency's website. The information shall be posted in a location that is easy to access by the public and must remain on the website for 1 full year after all construction is complete.

Implementation of either measure listed above will reduce NOx emissions during construction. The use of Tier 3 off-road vehicles will result in emission reductions as shown in Table 5-30. The use of Tier 3 only vehicles also results in reductions of other criteria pollutants: ROG, CO, PM10 and PM2.5.

Table 5-29: Alternative 9b Annual Construction Emissions

Calendar Year	ROG (tons/yr)	CO (tons/yr)	NOx (tons/yr)	SO_2 (tons/yr)	PM10 (tons/yr)	PM2.5 (tons/yr)	CO_2e (metric tons/yr)
2019	1.5	10.1	19.1	0.4	7.2	2.0	4,461
2020	1.4	10.1	16.7	0.4	7.1	2.0	4,415
2021	1.3	10.2	13.4	0.4	7.1	1.9	4,407
2022	1.9	18.0	16.3	0.4	7.5	2.1	5,986
2023	1.8	17.9	14.9	0.4	7.4	2.1	5,978
2024	1.7	17.9	13.9	0.4	7.4	2.0	5,981
2025	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2026	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2027	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2028	1.3	14.2	10.0	0.3	6.7	1.7	3,560
2029	0.6	5.9	5.0	0.3	5.3	1.3	1,812
2030	0.4	4.3	3.3	0.3	5.8	1.3	1,021
2031	0.4	4.0	3.0	0.2	4.7	1.1	857
SJVAPCD Threshold	10	100	10	27	15	15	None
Exceed SJVAPCD Threshold?	No	No	Yes, 2019-2024	No	No	No	N/A
Conformity Threshold	10	100	10	100	100	100	25,000
Exceed Conformity Threshold?	No	No	Yes, 2019-2024	No	No	No	No

SO_2 emissions not estimated by RCEM. However, SO_2 typically less than 5 percent of PM10 exhaust. Consequently, SO_2 conservatively assumed to equal 5 percent of PM10.

Table 5-30: NOx Reductions from Implementation of Tier 3 Mitigation

Construction Year	NOx Reductions
2019	54 percent
2020	50 percent
2021	44 percent
2022	40 percent
2023	35 percent
2024	29 percent
2025-2029	17 percent

NOx emission reduction percentages calculated using CalEEMod2013.2.2. Numbers reflect reductions of an all Tier 3 fleet compared to average fleet mix.

Table 5-31 shows the resulting mitigated NOx emissions using Tier 3 vehicles. This mitigation would reduce emissions to below 10 tons per year during all years of construction.

Table 5-31: Alternative 9b Mitigated NOx Emissions

Year	NOx (tons/yr)	Year	NOx (tons/yr)
2019	8.8	2026	8.2
2020	8.4	2027	8.2
2021	7.5	2028	8.2
2022	9.7	2029	4.1
2023	9.7	2030	2.8
2024	9.8	2031	2.5
2025	8.2		
SJVAPCD Threshold	10	Conformity Threshold	10
Exceed SJVAPCD Threshold?	No	Exceed Conformity Threshold?	No

Alternatively, the purchase of emission offsets through a VERA would completely offset the Project's NOx emissions from 2019 through 2029. Table 5-32 shows the estimated cost of entering into a VERA to offset the 94.3 tons of NOx that would be emitted by Alternative 9b between 2019 and 2024.

Table 5-32: Alternative 9b Construction NOx Mitigation Fee Calculation

Total Unmitigated NOx Exceeding 10 Tons per Year	94.3
Estimated Mitigation Fee (per ton)	$ 9,350
Total Cost	$ 881,705
Cost per ton is based on the San Joaquin Valley Air Pollution Control District's NOx fee included in their Indirect Source Rule 9510.	

With implementation of either measure, the use of all Tier 3 vehicles or a VERA, this impact would be reduced to **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction activities would generate short-term emissions of DPM exhaust. CARB identified DPM as a TAC. In assessing health risks from TACs, the dose to which sensitive receptors are exposed is the primary factor used to evaluate health risks. The potential impacts of exposure to TACs is the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

During construction, diesel exhaust produced by off-road construction equipment could generate odors. However, the potential impact is the same as Alternative 7a. Therefore, this impact is considered to be **less than significant**.

Mitigation

No mitigation is required.

Impact

Maintenance related activities would occur periodically once construction has been completed. Such maintenance activities would be the same as in Alternative 7a. Therefore, this impact would be **less than significant**.

Mitigation

No mitigation is required.

Impact

Construction equipment, material delivery trucks and employee trips would be operated during in-place levee reconstruction and improvements. The resulting combustion of diesel and gasoline would emit GHGs. The mitigation measures for 9B_AQ-1 would be the same as Alternative 7a.

Mitigation

No mitigation is required.

Impact

Levee repairs and improvements would provide future flood risk protection, as well as carbon sequestration due to restoration of riparian habitat associated with levee repair and improvement. Providing flood protection would result in net avoided GHG emissions associated with emergency response and rebuilding of flooded communities. Based on a review of this alternative, the following can be determined:

- The construction-related and operational GHG emissions would not conflict with or be inconsistent with any current plan to reduce or mitigate GHGs.
- Emissions would not exceed 25,000 metric tons of CO_2e per year (Table 5-29).
- Implementation would reduce flood risks and therefore would reduce future GHG emissions resulting from flooding or flood damage remediation.

Based on this evaluation, Alternative 9b's emissions would likely be offset to a substantial degree by avoided future GHG emissions from future flood damage prevention. Therefore, relative to existing conditions, the impact of the net change in GHG emissions would not be cumulatively considerable and this impact would be less than significant.

Mitigation

No mitigation is required.

5.9 VEGETATION

This section describes the affected environment and environmental consequences relating to vegetation for the LSJR project and the significance of the impacts and mitigation measures to reduce impacts.

5.9.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to vegetation are below and summarized in Chapter 7.

Federal

- Executive Order 13112: Invasive Species
- Federal ESA
- Fish and Wildlife Coordination Act (FWCA)

State

- California ESA
- CFGC, Section 1600
- California Native Plant Protection Act
- Porter-Cologne Water Quality Control Act

Local

- City of Lathrop General Plan (Polices 1, 2 and 7).
- City of Lathrop General Plan (Goal 5, Policy 6; Goal 10)
- San Joaquin County General Plan (Objectives 1 and 2, Policies 1, 4, 5, 6,8; San Joaquin County Titles 9-1505 and 9-1510)
- San Joaquin County Multi-species Habitat Conservation and Open Space Plan (SJCMSCP, San Joaquin County 2000)
- Stockton General Plan 2035 (NCR-1 and NCR-2)

USACE Levee Vegetation Management Policy, 1110-2-583 (Vegetation ETL)

New authorized projects are required by USACE policy to comply with ETL 1110-2-583, which calls for the removal of wild growth, trees and other vegetation that might impair levee integrity or flood-fighting access in order to reduce the risk of flood damage. In certain instances, to further enhance environmental values or to meet State or Federal laws and/or regulations, a variance can be requested from the standard vegetation guidelines. For a variance to be acceptable, safety, structural integrity and functionality of the levee must be maintained.

Issues with vegetation on levees are summarized as follows:

- Levee Visibility – Riparian vegetation can cause a reduction in visibility, particularly in very dense areas of vegetation. Levee visibility is important for inspection crews to identify problems in levee integrity such as the presence of burrowing animals, cracks, slumping and seepage.
- Accessibility. Vegetation can block access to the levee crest of landside of the levee for flood fight requirements and maintenance access purposes.
- Through-levee Seepage – Riparian vegetation roots can cause seepage problems and affect the general integrity of the levee.
- Windthrow – The root balls of felled trees during storms can displace relatively large amounts of earth, which can affect the strength of the levee or if on the waterside, increase the risk of scour.
- Slope Stability – Riparian vegetation can cause slope stability problems, particularly on the waterside of levees. Tree roots extending in the river flow can cause erosion near the toe of the levee, a particularly critical part in terms of slope stability.
- Burrowing Animals – Riparian vegetation may encourage the development of animal burrows detrimental to the levee or may reduce visibility of burrows.

Existing Conditions

Historic native vegetation in the project area has been highly altered and fragmented as a result of urbanization, agriculture, FRM and navigation projects, including levees and constructed channels like the Stockton Diverting Canal. Vegetation within the project area includes remnant Great Valley cottonwood riparian forest, Great Valley oak riparian forest, nonnative woodland, coastal and valley freshwater marsh, agricultural (row crops orchards and vineyards) and developed lands like lawns, parks and golf courses. Nonnative vegetation is interwoven throughout the landscape. Open water habitat includes rivers, tributaries, canals and ditches. Ditches may contain water seasonally or year-round.

Once, the SJR and tributaries were framed by dense riparian forest. Today, riparian vegetation consists of narrow linear strips and occasional patches of riparian forest and riparian scrub growing on or adjacent to the levee. Larger areas of riparian forest are present in some areas where the levee is set back from the river or tributary, leaving floodplain on the waterside of the levee. More detailed description of the vegetation in the project area is provided below and is also available in the SJCMSCP (San Joaquin County, 2000) and in the Draft EIS/EIR for the RD 17 early implementation project (AECOM, 2011).

The primary focus of this section will be on areas the LSJR project area (encompassing the construction footprint, O&M and utility easements, roadway alignment and potential borrow sites), with attention, although not measurements, for lands adjacent to the project area. The northern portion of the project area includes Mosher Slough, Fivemile Slough, Fourteenmile Slough, Tenmile Slough and Stockton Deep Water Ship Channel. The central and southern portions include the SJR and its tributaries, including Calaveras River, Smith Canal, Old Mormon Slough, French Camp Slough and Duck Creek. The southern part of the project area is comprised of French Camp Slough and the SJR around RD 17. It occurs within the Great Central Valley subdivision of the California Floristic Province in San Joaquin County (Hickman, Ed., 1993). The topography of the portions of the project area adjacent to the levees is relatively level with elevations ranging from less than 5 feet to 38 feet above mean sea level.

Vegetation Types in the Project Area

This section is based upon a literature review.

Riparian Communities

In general, riparian communities are among the richest community types, in terms of structural and biotic diversity, of any plant community found in California. Riparian vegetation provided important ecological functions, including: wildlife habitat; migratory corridor for wildlife; filtering out pollutants and shading waterways, thereby improving water quality; providing connectivity between waterways and nearby uplands; provision of biomass (nutrients, insects, large woody debris, etc.) to adjacent waterways; and, in some situations, reducing the severity of floods by stabilizing riverbanks. Riparian forests and woodlands – even remnant patches – are important wildlife resources, because they continue to be used by a large variety of wildlife species and because of their regional and statewide scarcity.

Shaded Riverine Aquatic Habitat. SRA habitat is the nearshore aquatic zone composed of instream woody material providing in-water cover and shoreline trees and shrubs providing overhead canopy cover. Overhanging trees and shrubs provide shade, an element of SRA cover important to the survival of many aquatic organisms, including fish. Overhanging vegetation moderates water temperatures, which is an important factor for various life stages of native fish species. The vegetation provides food and habitat for both terrestrial and aquatic invertebrates, which in turn serve as food for several fish species. Aquatic vegetation or in-water cover, provides a diversity of microhabitats that allow for high species diversity, abundance and a food source for instream invertebrates that in turn are eaten by several native fish species. Thus, a broad food base and extensive cover and habitat niches are supported by in-water cover. These values in turn create high fish diversity and abundance (USFWS, 1992). Additional discussion of SRA is provided in Section 5.11, FISHERIES.

Riparian Woodland. Riparian woodlands in the project area include cottonwood riparian woodland, valley oak riparian woodland, walnut riparian woodland and riparian scrub. Riparian habitats are considered to be among the most productive and diverse wildlife habitats in California. In addition to providing important nesting and foraging habitat, they function as wildlife movement corridors.

Great Valley Cottonwood Riparian Forest. Larger remnant patches of Great Valley cottonwood riparian forest located within the project area are dominated by large Fremont cottonwood trees and Goodding's willow. Most of the otherwise linear or smaller patchy areas of this community lack Fremont cottonwood and are represented by Goodding's willow, red willow, arroyo willow, narrow leaved-willow and scattered valley oak, Oregon ash and buttonbush. Native ground cover species, mainly found in the larger remnant patches of riparian forest, include California blackberry and wild rose. Common nonnative understory species found in most elements include Himalayan blackberry and tree tobacco. Most of the Great Valley cottonwood riparian forest community could also be characterized as Great Valley riparian scrub, which does not include Fremont cottonwood and is characterized by a shorter canopy and more uniform structure. However, this habitat is part of the Great Valley cottonwood riparian forest that was extensive and connected along this entire reach of the SJR and this document therefore describes all riparian habitat as such (AECOM, 2011).

Great Valley Oak Riparian Forest. Great Valley oak riparian forest is also located within the project area, occurring only on the landside of the levees. Two significant oak groves of very large, healthy valley oak trees are present on the landside in RD 17 and account for the majority of the Great Valley oak riparian forest; although several groups of smaller valley oak trees and individual valley oak trees scattered along the landside also contribute to this community. Although not measured, several of the largest trees in these landside oak groves present are close to 100 inches (diameter at breast height) dbh, which is a size that indicates they are possibly several hundred years old (Bartolome, 1997).

Herbaceous Community

Nonnative Annual Grasslands. Nonnative annual grassland occurs throughout the project area on levee slopes, along roadsides and in undeveloped parcels. These areas are dominated by nonnative annual grasses and ruderal vegetation and may support stands of noxious species. Ruderal vegetation and grassland generally occurs in disturbed areas, such as levee slopes and edges of agricultural fields and roads. Areas of pasture associated with residences are primarily annual grasses that are grazed by horses and were mapped as nonnative annual grassland. The annual grasslands in the project area contain a relatively large proportion of ruderal species, likely because of substantial disturbance from human activities.

Nonnative annual grassland is dominated by naturalized annual grasses with intermixed perennial and annual forbs. Grasses commonly observed in the project area are foxtail barley, ripgut brome, Italian ryegrass and soft chess. Other grasses are wild oats, Bermuda grass and rattail fescue. Forbs commonly observed in annual grasslands in the project area are yellow star-thistle, prickly lettuce, bristly ox-tongue, sweet fennel, Italian thistle, horseweed, black mustard, fireweed, broad-leaf pepper grass, common sunflower, pigweed, cheeseweed, bindweed and telegraph weed. The annual grasslands in the project area contain a relatively large proportion of ruderal species, likely because of substantial disturbance from human activities. Elderberry shrubs occur in several areas of nonnative annual grassland.

Ruderal vegetation is characterized by nonnative weedy and sometimes invasive vegetation and nonnative annual grasses. Common weed species include yellow star-thistle, black mustard, shortpod mustard, Italian thistle, milk thistle and Himalayan blackberry; common grass species include ripgut brome, foxtail barley, Bermuda grass and Johnsongrass. The levee slopes are dominated by ruderal vegetation. Large open areas in RD 17 are composed primarily of ruderal vegetation as are some smaller open areas that border roads, parking lots and agricultural land and Old Mormon Slough.

Agricultural Communities

In the project area, agricultural lands include row and field crops, fallow and disked agricultural fields orchards and vineyards. General farming practices result in monotypic stands of vegetation for the growing season and bare ground in the fall and winter. Irrigation ditches are a part of most agricultural fields in the project area.

Cropland occurs in RD 17, Shima Tract and Wright-Elmwood Tract northeast of the Stockton Diverting Canal and along the upper reaches of the Calaveras River. Ruderal species grow along the edges of fields and irrigation ditches, some of which contain water and associated aquatic plants.

Developed Lands

Developed lands in the project area include levee roads, railways, roads, buildings and landscaped areas as well as barren areas that were disturbed and are not vegetated. Developed areas consist of residential areas, parks, boat launching facilities, docks and ranch houses and related facilities. Vegetation in residential areas and parks consists of turf grasses, landscape trees and occasional valley oak trees. Ranch lands often contain a variety of landscape trees and shrubs and occasional native trees including valley oak trees. In north and central Stockton, most of the areas landside of levees in the project area are "developed." This is also true of lands in the northern portion of RD 17 (Weston Ranch) and in southern RD 17 near Lathrop and Manteca.

Vegetation by Project Reach

Throughout the project area levee crowns are either paved or graveled for access and inspection and are generally devoid of vegetation.

Mosher Slough

Mosher Slough runs through a highly urbanized area. Woody riparian vegetation is most robust near the confluence with Fourteenmile Slough. It is comprised of typical Valley riparian trees and shrubs. Emergent wetland vegetation occurs intermittently at the water's edge. Landside vegetation includes nonnative landscape trees and shrubs as well as natives. Typical wetland vegetation line some stretches of this reach.

Fourteenmile Slough, Fivemile Slough, Tenmile Slough

Waterward of the levees, some woody riparian trees and shrubs boarder these highly engineered waterways. Within some of the sloughs and canals, aquatic weeds cover much of the water surface. Along the edges of the waterways, wetland vegetation is present intermittently. Within Fourteenmile Slough, intertidal vegetation is present on rocky substrate that is exposed during low tides. In Buckley Cove, near the confluence of Tenmile Slough with the Stockton Deep Water Ship Channel, wetland and subtidal vegetation is present along with aquatic weeds. Landside vegetation is comprised mainly of row crops with some parcels in orchard.

Stockton Deep Water Ship Channel

Native vegetation is mostly absent along the Stockton Deep Water Ship Channel, the exception being some scattered trees and shrubs along the landside toe drain and irrigation ditches.

SJR

On the SJR, lands waterside of the levees are very narrow and support a remnant riparian forest. Trees and shrubs occur in small patches or may be scattered individuals. Vegetation on the waterside of levee slopes is highly varied, ranging from ruderal herbaceous vegetation and annual grasses with few shrubs, to dense shrubs with little overstory, to mature riparian forest. Potential SRA cover is found along much of the river in the Central Stockton portion of the project area.

Dominant waterside tree species include cottonwood, willow, oak, box elder and black walnut. In the project area, common shrub species include willow, wild rose and blackberry. Elderberry shrubs are also present in some locations. Ruderal herbaceous vegetation is present on levee slopes. In some places, the tree overstory along the levee is so dense that the leaf fall and shading, as well as human activity, precludes development of dense understory vegetation (USFWS, 2007). At Dos Reis road, there is a park on both sides of the levee where vegetation includes willows, weeping willow, cottonwood, fruitless mulberry, mesquite (thorns), elderberry and mistletoe.

Landside levee slopes are primarily barren or covered with ruderal vegetation. Beyond the base of the levees, riparian vegetation is rare but occasionally present in small isolated patches. Other trees include occasional single or isolated stands of native oaks and nonnative trees planted around farms, agricultural fields and residential or other types of development. Larger remnant patches of Great Valley cottonwood riparian forest located within the study area are dominated by large Fremont cottonwood trees and Goodding's willow (AECOM, 2011). Most of the otherwise linear or smaller patchy areas of this community lack Fremont cottonwood and are represented by Goodding's willow, red willow, arroyo willow, narrow leaved-willow and scattered valley oak, Oregon ash and buttonbush (AECOM, 2011). Native ground cover, mainly found in the larger remnant patches of riparian forest, include California blackberry and wild rose. Common nonnative understory species found in most elements include Himalayan blackberry and tree tobacco. Most of the Great Valley cottonwood riparian forest community could also be characterized as Great Valley riparian scrub, which does not include Fremont cottonwood and is characterized by a shorter canopy and more uniform structure; however, this habitat is part of the

Great Valley cottonwood riparian forest that was extensive and connected along this entire reach of the SJR and this document therefore describes all riparian habitat as such (AECOM, 2011).

Calaveras River

Levees and the lands adjacent to both the waterside and landside of the levees in the reach of the Calaveras River above and just below, the Stockton Diverting Canal are largely devoid of trees and shrubs. The exception is some orchards landward of the north levee. Moving downstream, more trees and shrubs are present on and adjacent to the levees. In the highly urbanized reaches, many of the landside trees and shrubs are associated with landscape plantings in yards, parks and public rights of way. Wetland vegetation appears to line the channel in places.

Stockton Diverting Canal (SDC)

Levees defining the SDC are clear of woody vegetation. Immediately landside of the southwestern levee is mainly urban and industrial uses, with a small portion in the southeast in agriculture (row crops and orchard). Landside of the northeastern levee is about equally divided between urban/industrial uses and agriculture. Waterward of both levees some native woody small trees and shrubs are scattered and wetland vegetation occurs at the water's edge in some stretches.

Smith Canal

Smith Canal is surrounded by urban residential areas, including hard-scaping (sidewalks) and some landscape plantings adjacent to the water's edge. Near the confluence of the canal with the SJR, there is a public park, including a picnic area, boat launch ramp and associated infrastructure. There is an irrigated lawn and a mixture of native and nonnative trees and shrubs. Wetland vegetation is prevalent at the water's edge and nonnative invasive water plants inhabit the "bay" near the boat launch ramp. Invasive waterweeds occupy much of the inlet in the vicinity of the boat launch ramp.

Mormon Slough and Old Mormon Slough

Before construction of the Stockton Diverting Canal, Old Mormon Slough was connected to Mormon Slough and was perennial in most years. Today, the channel receives local stormwater runoff and intermittently contains water. Vegetation in and adjacent to the channel ranges from orchard and row crops, landscape plants, residual stands of native riparian plants, like willows and oaks and some isolated wetland plants. At the confluence of Old Mormon Slough with the SJR, riparian vegetation becomes taller and denser and well developed wetland vegetation is present.

French Camp Slough and Duck Creek

Levees along Duck Creek are clear of trees and shrubs. Adjacent lands are largely in agriculture with urban development beginning to extend into them. French Camp Slough upstream of the confluence with Duck Creek is very similar in character to Duck Creek. Levees are free of trees and shrubs and adjacent lands are in agriculture with urban lands extending towards the leveed slough.

The lower reaches of French Camp Slough (between Duck Creek and the SJR) are surrounded landward by urban development. The Weston Ranch residential development is immediately to the south in the northern portion of RD 17. A municipal golf course is adjacent to the northern bank/levee of French Camp Slough in Central Stockton. Between the north and south French Camp Slough levees is an "island" of land that is in agriculture. The perimeter of this island contains a fairly thick margin of trees and shrubs. The stretch along the SJR includes willow pole plantings installed by USACE as part of PL 84-99 levee rehabilitation efforts after the high water events of 2006.

In this lower French Camp Slough reach, the levee crown includes a paved road. The landside levee slope and toe are mostly devoid of vegetation. There are some annual grasses and herbs. These are largely nonnative weedy plants. Where trees and shrubs are present within the landside easement, they are mainly landscape plantings associated with public rights of way and private yards. The waterside levee slope and easement have trees and shrubs throughout their length, being quite dense in some areas. Trees include native valley oak, box elder, cottonwood, black walnut and willows. Elderberry shrubs and poison oak are also present. Snags are present as are patches of dead willow shrubs. In the canal between the RD 17 levee and the mid-channel island to the north, wetland plants are abundant. These include tules, nut sedges and tule potato. Water hyacinth, mistletoe and nonnative English walnut trees are also present.

Invasive Plants

Invasive plants in the project area include trees, shrubs, vines, grasses and herbs. These are species that are commonly encountered along Central Valley water courses and in vacant lands on the valley floor. In considering invasive species presence in the project area, the following resources were consulted: the California Department of Food and Agriculture Pest *Ratings of Noxious Weed Species and Noxious Weed Seed* (California Department of Food and Agriculture, 2010); the California Invasive Plant Council's California Invasive Plant Inventory (California Invasive Plant Council 2006 (downloaded May 2013); 2007 CAL-IPC News with new species added to the inventory. The May reconnaissance site visit documented the occurrence of a number of these species on and adjacent to the existing levee and in Old Mormon Slough.

Nonnative species observed in the area (AECOM, 2011) include: barley, ripgut brome, Italian ryegrass and soft chess. Other grasses are wild oats, Bermuda grass and rattail fescue. Forbs commonly observed in annual grasslands in the project area are yellow star-thistle, prickly lettuce, bristly ox-tongue, sweet fennel, Italian thistle, horseweed, black mustard, fireweed, broad-leaf pepper grass, common sunflower, pigweed, cheeseweed, bindweed and telegraph flora. Nonnative invasive trees and shrubs in the project area include: Tree of Heaven and Himalayan blackberry. Mistletoe is also found throughout the area.

5.9.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

The methods used to identify and evaluate potential effects of the action alternatives on vegetation and wetland resources in the project area consisted of: a literature review focused on recent environmental documents and surveys addressing the project area; a reconnaissance-level site visit; review of the USFWS' draft FWCA (USFWS, 2014) prepared for the LSJRFS; and viewing the landscape using Google Earth™ imagery and measurement tools. Coordination with USFWS and NMFS also contributed to this assessment.

Within the potential project construction and O&M footprints, the extent of existing woody vegetation, irrigated grass, golf courses and some wetlands was measured using the polygon measuring feature of Google Earth. The California Natural Diversity Database (CNDDB), California Native Plant Society's (CNPS's) *Inventory of Rare and Endangered Plants of California* and a USFWS list of species for the project region (CNDDB 2012; USFWS, 2013) were also consulted.

Reconnaissance-Level Site Visit and Vegetation Cover Mapping

USACE, DWR and USFWS biologists conducted a reconnaissance-level visit to representative sites throughout the project area to observe existing vegetation and land cover. The field visits were conducted on May 29 and May 30, 2013. The purposes of these visits were to, at a reconnaissance level:

- Identify vegetation and land cover types.
- Evaluate whether potential habitat may be present for special-status plant species that were identified in the project region.
- Identify potential waters of the U.S. and/or State, including wetlands.
- Identify invasive plant species present in the project area.

Vegetation cover mapping is broad-brush due to the limitations of the satellite imagery available through Google Earth™. Vegetation mapped is: waterside trees and shrubs; landside trees and shrubs; wetlands; orchards/vineyards; row/field crops; irrigated grass; and ruderal vegetation. Vegetation typical of these broad categories is described in this section based upon observations during the reconnaissance visits and the literature review.

Impacts

The key effects were identified and evaluated based on the environmental characteristics of the project area, with specific attention to the footprint of the potential project and the magnitude, intensity and duration of activities related to the construction and operation of the proposed action alternatives.

Addressing Uncertainty Under NEPA and CEQA

Both NEPA and CEQA describe how impact analysis may proceed when complete information is lacking. In these circumstances, the CEQ and CEQA encourage the use of incremental decision making through tiering and/or sequencing of impact analyses to ensure continued progress towards the critical path of meeting the overall project purpose and need (40 CFR 1508.28 and CEQA Guideline Sections 15152 and 15168).

In this FR/EIS/EIR, the anticipated construction-related activities associated with implementing the proposed action alternatives are addressed at a level considered appropriate given the current status of project planning and design and available information and data. As planning proceeds, USACE, CVFPB and SJAFCA will continue to refine measures, construction methods, equipment types and construction schedules with the intent of further reducing adverse impacts.

The approach used in this impact analysis is expected to overestimate the extent of existing vegetation and the extent of impacts on vegetation. As project planning proceeds, refinements to the measures and designs are anticipated and additional field-level information will become available to facilitate refinements to the impact assessment.

Effect Assumptions

The following assumptions were made regarding project effects on vegetation.

General Construction Impacts

- All construction activities, including equipment staging and access, would take place only within the project area footprint or in existing off-site developed areas.
- For all alternatives, construction would be phased and occur over 12 years.

Construction Impacts on Vegetation

- Construction of levee cutoff walls and slope reshaping would both result in removal of landside and waterside woody riparian vegetation.
- Construction of seismic fixes would require removal of vegetation from levee slopes and both the waterside and landside easements.
- Construction of levee height fixes and increases (to address sea level rise) would require removal of all vegetation from the landside levee slope and easement.
- For all proposed alternatives: new, reshaped or reconstructed levee slopes; seepage berms; would be hydroseeded with native grassland species after construction. These areas would, therefore, comprise upland habitat after construction.
- Loss of agricultural and annual grassland vegetation (ruderal vegetation) would not be considered a significant adverse effect from a biological resource standpoint. These habitats are common and not considered sensitive native community types. They are also more easily reestablished after disturbance than riparian or wetland communities. The loss of agricultural and annual grassland habitats could be adverse for wildlife, however. This effect is discussed in Section 5.10, WILDLIFE.
- Throughout the project area, levee crowns are either paved or graveled for access and inspection and generally devoid of vegetation. Except where trees and shrubs are present, impacts to levee crowns would not be considered a significant impact.

Borrow

- Specific borrow locations have not been identified for the proposed project, but it is assumed that sufficient suitable materials would be available within a 25 mile radius. It is likely that borrow would come from lands that are currently in agriculture or fallow. Thus, impacted vegetation would be orchards/vineyards, row or field crops or ruderal vegetation. Sensitive habitats, including wetlands, would be avoided. Prior to excavating borrow, top soil would be removed and set aside. Once material is extracted, the topsoil would be replaced and the borrow sites would be returned to their existing use wherever possible. Some borrow sites could be used to mitigate for project impacts, if appropriate.

Vegetation ETL

- Compliance with USACE ETL 1110-2-583 vegetation requirements would be established at the time of construction of flood features in each reach. This would include either receipt of a vegetation variance, which would allow 25 percent of the waterside vegetation to remain on the lower two thirds of the levee slope and within the waterside easement, of full compliance with the VFZ in areas where a variance is not granted. The VFZ extends from 15 feet landward of the levee to 15 feet waterward and includes the levee slopes and crown.
- The VFZ would be seeded with a mixture of native grasses and forbs. No woody vegetation would be planted or allowed to grow on levees that comply with the VFZ or within 15 feet of them. Routine project O&M will include maintaining these VFZs.
- If a vegetation variance is granted, USACE will seek opportunities to plant waterside vegetation as compensation for impacts to SRA and woody riparian habitats in accordance with the terms and conditions of the NMFS BO.

Operation and Maintenance

- To establish, reestablish or maintain the required O&M and the inspection road on the landside of the levee, trees and shrubs would be removed from the landside from the levee toe, approximately 20 feet landward on new levees and between 10 and 20 feet on existing levees, consistent with existing O&M agreements. This O&M easement would be maintained clear of trees and shrubs through routine O&M (up to 4 times per year).

Effect Mechanisms

Vegetation and wetland resources could be directly and indirectly affected by the project alternatives. The following types of activities could cause varying degrees of effects on these resources.

- Vegetation removal for seepage berm and levee construction; utilization of borrow sites and re-contouring of the existing levee.
- Grading and fill placement during construction of levee alternatives.
- Placement of slurry cutoff walls, interrupting groundwater connectivity.
- Channel dewatering or installation of temporary water-diversion structures.
- Temporary stockpiling and side-casting of soil, construction materials or other construction wastes.
- Soil compaction, dust and water runoff from the construction site into adjacent areas.
- Introduction or spread of invasive plant species into adjacent open space areas.
- Runoff of herbicides, fertilizers, diesel fuel, gasoline, oil, raw concrete or other toxic materials used for levee construction, O&M into sensitive biological resource areas (e.g., riparian habitat, wetlands).
- Placement of rock slope protection on the waterside of levees.
- O&M activities, including removal of weeds, tree and shrub trimming up to 4 times per year and reconditioning of levee slopes and road with a bulldozer, as needed.

Basis of Significance

For this analysis, an environmental effect was significant if it would result in any of the effects listed below. These effects are based on NEPA standards, State CEQA Guidelines Appendix G (14 CCR 15000 et seq.) and standards of professional practice.

- Substantial loss, degradation or fragmentation of any natural communities or wildlife habitat.
- Substantial effects on any riparian habitat or other sensitive natural community identified in local or regional plans, policies or regulations or by NMFS, USFWS or CDFW.
- Conflict with the provisions of the San Joaquin County Multi-species Conservation and Open Space Plan (2000).
- Conflict with the San Joaquin County General Plan, City of Stockton General Plan, Lathrop General Plan or the Manteca General Plan.

Effects on Vegetation

Impacts to vegetation for all alternatives are summarized in Table 5-33.

Table 5-33: Vegetation Effects by Alternatives

Vegetation	Alternatives					
	7a	7b	8a	8b	9a	9b
Natural Lands						
SRA (lf)	19,630	49,586	25,674	51,985	25,508	51,819
Riparian Trees and Shrubs (acres)	139	274	160	245	152	237
Wetlands (acres)	10.75	15	11	15	11	15
Agricultural Lands						
Orchards/Vineyards (acres)	0	95	0	95	4	99
Row/Field Crops (acres)	15	32	15	32	16	33
Irrigated Grass						
Irrigated Grass (acres)	10	10	10	10	10	10

USACE Levee Vegetation Management Policy, ETL 1110-2-583 (Vegetation ETL)

New authorized projects are required by USACE policy to comply with ETL 1110-2-583. For purposes of this feasibility study and impact assessment, USACE intends to pursue a vegetation variance, where appropriate, during PED. Where suitable, a vegetation variance would allow approximately 25 percent of waterside woody vegetation to be retained on the lower two thirds of the waterside levee slope and within 15 feet of the waterside levee toe. Under each alternative, compliance with the levee vegetation requirements through a variance would still result in permanent loss of trees and shrubs on and adjacent to the landside and upper third of levees and related FRM features, and a 75 percent reduction in trees and shrubs on the lower portion of the levee and within the waterside easement. This would have a substantial adverse and permanent effect from loss of riparian habitat. Therefore, for all alternatives these effects are considered permanent, **significant and unavoidable**.

5.9.3 ALTERNATIVE 1 - NO ACTION

In general, the No Action Alternative represents the continuation of existing levee conditions in the project area. USACE would not participate in construction of the proposed project. The No Action Alternative

assumes continued application of the existing O&M Manuals. Further, it assumes the continued existence of the vegetation conditions at the time of the analysis and assumes that maintenance would maintain generally the same configuration and extent of vegetation, except that it is assumed that trees and shrubs would continue to grow and mature. The consequences of levee failure and flooding are described under the No Action Alternative Description in Chapter 4, including a summary of environmental effects.

Without improvements to the levees and associated features of the FRM system, current levee system would not meet current state ULE criteria or Federal design standards for sea level rise. Flood fight activities would occur during a high flow emergency response. Flood fighting is usually performed by placing large rock along the levee slope to stop erosion and prevent levee failure and loss of lives. The placement of rock would prevent or impede future growth of trees and vegetation on the levee slopes. In the event that flood fighting activities were not successful and a levee failure occurred, all vegetation would be lost. The magnitude of the impacts would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.9.4 ALTERNATIVE 7A

Overall, the following vegetation could be removed or directly affected by implementation of Alternative 7a: 19,630 lf (lf) of SRA, 139 acres of riparian trees and shrubs, and 10.75 acres of wetlands. All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint.

North Stockton

Mosher Slough

Construction of cutoff walls on the southern levees between Thornton Road and the railroad tracks would require degrading the top half of the levee before installing the cutoff wall and reconstructing the levee. This would result in removal of all vegetation on the upper half of the levees. Construction would occur from the top of the levee. The lower half of the waterside and landside levee slopes would not be directly affected by construction of project features. There could be some indirect impacts to this vegetation due to dust and vibration. Likewise, the waterside and landside easement would not be directly affected by construction of the levee cutoff walls.

From Shima Tract to Thornton Road, a cutoff wall would be installed and the levees would be raised to reduce risk from sea level rise. Waterside surface would remain where it is and the levee would be raised and extended landward. All vegetation would be removed from: the upper half of the waterside levee slope; all of the landside slope; and, all of the landside easement. Vegetation would remain on the lower half of the levee and within the waterside easement. There could be indirect impacts to this vegetation due to dust, vibration and movement of disturbed soils down-slope.

Construction on Mosher Slough would directly affect 21.5 acres of riparian trees and shrubs and 3 acres of wetlands on the levee and within 15 feet of the toe of the levee. This impact would be **significant and**

unavoidable because there would be a permanent loss of riparian habitat, including wetlands and loss of natural communities and wildlife habitat.

Fourteenmile Slough, Fivemile Slough, Tenmile Slough

A cutoff would be installed in the eastern levee of Shima Tract and erosion protection placed on the landside of the levee to provide protection from high water events originating from the West (Delta). As described above, cutoff wall construction would entail degrading the top half of the levee, installing and then reconstructing the levee. All vegetation would be removed from the top half of both the landside and waterside levee slopes. The lower half of the waterside levee slope and the waterside easement would not be affected by project construction. Because of the addition of erosion protection on the landside of the levee, the lower half of the levee and the easement would be affected by project construction.

The remainder of the levee improvements consist of a combination of levee slope reshaping, landside erosion protection and/or levee height fixes. Construction of these levee improvements would require removal of all levee slope and levee easement vegetation. Improved FRM in this reach includes installation and operation of a closure structure. This structure would permanently affect 0.5 acres of open water and intertidal habitat. An additional 1 acre would be affected during construction of the closure structure.

Construction on Shima Tract, Fivemile Slough, Fourteenmile Slough and Tenmile Slough would directly affect 4 acres of waterside wetlands and 30.75 acres of woody riparian trees and shrubs. It would also affect 3.5 acres of irrigated grass on the levee slope and 1 acre of irrigated grass in the landside easement. This impact would be **significant and unavoidable**, because there would be a permanent loss of riparian habitat, including wetlands and loss of natural communities and wildlife habitat.

Central Stockton

Calaveras River

Most improvements to Calaveras River levees would be cutoff walls. Construction of these walls would require removal of all vegetation from the top half of the levee and the landside slope. Construction on the Calaveras River levees would result in the removal of 52 acres of woody riparian trees and shrubs. Vegetation on the lower half of the levee could experience indirect impacts through dust and vibration. These impacts would be transient and no permanent impacts would be anticipated.

One stretch of improvements on the north levee and one along the south levee, would entail installation of a cutoff wall, slope reshaping and a height fix. Constructing these features would require removal of all vegetation on the top half of the levee and could require removal of vegetation on the lower half of the levee as well. Additionally, this could result in the removal of approximately 1.75 acres of waterside wetlands. Construction would impact up to the entire landside easement.

Construction of levee improvements on the Calaveras River would impact waterside and landside trees and shrubs and wetlands. This impact would be **significant and unavoidable**, because there would be a permanent loss of 52 acres of riparian habitat, including approximately 7,800 lf of SRA habitat, 1.75 acres of wetlands and loss of natural communities and wildlife habitat.

Stockton Diverting Canal

Alternative 7a does not include any work on the Stockton Diverting Canal. Therefore, there would be no project-related impacts on vegetation in this reach.

Smith Canal

Impacts to vegetation from construction of the Smith Canal closure structure would be **less than significant** within the canal and **significant** because construction would remove vegetation on the lands at the mouth of the canal. These impacts to vegetation are captured in the subsection below describing vegetation impacts along the SJR in this project reach.

SJR 2,100 feet upstream of the Calaveras River to French Camp Slough

Along this reach of the SJR, with the exception of Atherton Island, levee improvements would include a cutoff wall, which would require removal of all vegetation on the upper half of the levee slope. From 2,100 feet upstream of the Calaveras River to the Smith Canal, the levee height would be restored to design height and the level would be raised to address sea level rise. This would require removal of vegetation on the landside of the levee and easement to accommodate construction and the increased width of the levee that would result from increasing the height. From the railroad bridge just upstream of the Port of Stockton to Burns Cutoff, levee slopes, in addition to a cutoff wall, would need to be reshaped and the design height would need to be restored. This would impact all vegetation on the levee slopes and the vegetation in the landside levee easement.

Construction would impact approximately 6,000 lf of SRA and 17 acres of riparian trees and shrubs. This impact would be **significant and unavoidable** because construction there would be a permanent loss of riparian habitat, including SRA and loss of natural communities and wildlife habitat.

French Camp Slough and Duck Creek

Levees along Duck Creek are clear of trees and shrubs. Adjacent lands are largely agriculture with urban development beginning to extend into these lands. French Camp Slough upstream of the confluence with Duck Creek is very similar in character to Duck Creek. Construction of the new Duck Creek levee would result in impacts to 2 acres of riparian trees and shrubs and 2 acres of wetlands. Project construction and compliance with the Vegetation ETL would have a **less than significant** impact in these areas.

Levees along French Camp Slough would be improved through installation of a cutoff wall. This would require removal of 15.75 acres of woody riparian trees and shrubs, including approximately 5,500 lf of SRA habitat. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and loss of natural communities and wildlife habitat.

5.9.5 ALTERNATIVE 7B

Vegetation that could be removed as a result of project construction under Alternative 7b. Impacts on vegetation would be similar to those described for Alternative 7a except that Alternative 7b includes levee improvements and new levee segments in RD 17. Overall, the following vegetation could be removed or directly affected by implementation of Alternative 7b: 49,586 lf of SRA, 92 acres of waterside trees and shrubs, 135 acres of landside trees and shrubs and 15 acres of wetlands.

All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to be allowed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint. Details of impacts by location for Alternative 7b are provided below.

North Stockton
(Mosher Slough, Tenmile Slough, Fivemile Slough, Fourteenmile Slough)

Under Alternative 7b, the levee improvements and gates proposed along with their impacts are the same as those proposed under Alternative 7a. The impacts would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including wetlands and loss of natural communities and wildlife habitat.

Central Stockton
(Calaveras River, Smith Canal, Stockton Diverting Canal, SJR upstream of the Calaveras River to French Camp Slough and Duck Creek)

Under Alternative 7b, the levee improvements and gates proposed are the same as those proposed under Alternative 7a, except that Alternative 7b does not include construction of a new levee extension on Duck Creek. Nevertheless, Alternative 7b would result in **significant and unavoidable** impacts to vegetation because they represent a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

RD 17

French Camp Slough

Like the northern French Camp Slough levees that are part of Central Stockton, the southern levees would be improved through installation of a cutoff wall. Construction would require removal of SRA, waterside and landside trees and shrubs and wetlands. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

SJR

Levee improvements along the SJR include construction of cutoff walls, levee slope reshaping, restoration of levee heights where needed, construction of new levee segments construction of landside seepage berms and erosion protection. Construction would require removal of SRA, waterside and landside trees and shrubs and wetlands throughout the entire project footprint. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

5.9.6 ALTERNATIVE 8A

Under Alternative 8a, the effects would be similar to that described for Alternative 7a, except that the impacts would extend further upstream on the Lower Calaveras River and on the southwestern levee of the Stockton Diverting Canal. Overall, the following vegetation could be removed or directly affected by implementation of Alternative 8a: 25,674 lf of SRA, 37 acres of waterside trees and shrubs, 123 acres of landside trees and shrubs and 11 acres of wetlands.

All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to be allowed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint.

North Stockton
(Mosher Slough, Tenmile Slough, Fivemile Slough, Fourteenmile Slough)

Alternative 8a includes the same flood system improvements and vegetation impacts as are described for Alternative 7a. Therefore impacts to vegetation would be **significant and unavoidable** because there would be a permanent loss of riparian habitat and wetlands and loss of natural communities and wildlife habitat.

Central Stockton
(Calaveras River, Smith Canal, Stockton Diverting Canal, SJR upstream of the Calaveras River to French Camp Slough and Duck Creek)

Alternative 8a includes the same flood system improvements and vegetation impacts as are described for Alternative 7a, except that additional levee improvements would occur on Calaveras River and on the Stockton Diverting Canal. Some wetlands would be affected, but there are few trees and shrubs on the Stockton Diverting Canal or the additional reaches of the Calaveras River. Impacts to vegetation on the Calaveras River, Smith Canal and the SJR upstream of the Calaveras River to French Camp Slough would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

Stockton Diverting Canal and Duck Creek

Levees along the Stockton Diverting Canal would be improved through installation of a cutoff wall. Construction would require removal of all vegetation on the upper half of the levee slopes. Further, Duck Creek is clear of woody vegetation. Most of these levees are maintained clear of woody vegetation. There are just a few scattered trees that would be removed during construction on the levee slopes along the Stockton Diverting Canal. This impact would be **less than significant**.

5.9.7 ALTERNATIVE 8B

Overall, the following vegetation could be removed or directly affected by implementation of Alternative 8b: 51,985 lf of SRA, 92 acres of waterside trees and shrubs, 153 acres of landside trees and shrubs and 15 acres of wetlands. This impact would be **significant** because it represents a substantial adverse effect on riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to be allowed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint.

North Stockton
(Mosher Slough, Tenmile Slough, Fivemile Slough, Fourteenmile Slough)

Alternative 8b includes the same flood system improvements and vegetation impacts as are described for Alternative 7a. Therefore impacts to vegetation would be **significant and unavoidable** because there would be a permanent loss of riparian habitat and wetlands and loss of natural communities and wildlife habitat.

Central Stockton
(Calaveras River, Smith Canal, Stockton Diverting Canal, SJR upstream of the Calaveras River to French Camp Slough and Duck Creek)

Alternative 8b includes the same flood system improvements and vegetation impacts as are described for Alternative 7a, except that additional levee improvements would occur on Calaveras River and on the Stockton Diverting Canal. Some wetlands would be affected, but there are few trees and shrubs on the Stockton Diverting Canal or the additional reaches of the Calaveras River. Impacts to vegetation on the Calaveras River, Smith Canal and the SJR upstream of the Calaveras River to French Camp Slough would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

Stockton Diverting Canal and Duck Creek

Levees along the Stockton Diverting Canal would be improved through installation of a cutoff wall. Construction would require removal of all vegetation on the upper half of the levee slopes. Further, Duck Creek is clear of woody vegetation. Most of these levees are maintained clear of woody vegetation. There are just a few scattered trees that would be removed during construction on the levee slopes along the Stockton Diverting Canal. This impact would be **less than significant**.

RD 17

Alternative 8b includes the same flood system improvements and vegetation impacts in RD 17 as Alternative 7b that would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

5.9.8 ALTERNATIVE 9A

Overall, the following vegetation could be removed or directly affected by implementation of Alternative 9a: 25,508 lf of SRA, 37 acres of waterside trees and shrubs, 115 acres of landside trees and shrubs and 11 acres of wetlands. This impact would be **significant** because it represents a substantial adverse effect on riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to be allowed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint.

North Stockton
(Mosher Slough, Tenmile Slough, Fivemile Slough, Fourteenmile Slough)

Alternative 9a includes the same flood system improvements and vegetation impacts as Alternative 7a. Therefore, impacts to vegetation would be **significant and unavoidable** because there would be a permanent loss of riparian habitat and wetlands and loss of natural communities and wildlife habitat.

Central Stockton
(Calaveras River, Smith Canal, Old Mormon Slough, SJR upstream of the Calaveras River to French Camp Slough and Duck Creek)

Alternative 9a proposes the same flood system improvements and would result in the same vegetation impacts as Alternative 7a, except that there would be construction of a diversion structure at the confluence of Old Mormon Slough with the Stockton Diverting Canal and excavation within Old Mormon Slough in order to establish the channel as a flood bypass (Mormon Channel Bypass). Impacts to vegetation would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

Mormon Channel Bypass

A diversion structure would be constructed in the left bank of the SDC and floodflows (1,200 cfs every 2 years) would be reintroduced to Old Mormon Slough below its confluence with the SDC. Channel improvements and improvements to existing roads and other infrastructure would require removal of a large number of trees and shrubs. Reintroducing flood flows to Old Mormon Slough by establishing the Mormon Channel Bypass would improve conditions for the remaining vegetation and would likely increase the health and encourage expansion of riparian vegetation along much of this channel. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

5.9.9 ALTERNATIVE 9B

Overall, the following vegetation could be removed or directly affected by implementation of Alternative 9b: 51,819 lf of SRA, 92 acres of waterside trees and shrubs, 135 acres of landside trees and shrubs and 15 acres of wetlands. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

All woody riparian vegetation not removed for construction of the structural FRM features would be removed to achieve compliance with the Vegetation ETL, with the exception of approximately 25 percent of the waterside vegetation, which is assumed to be allowed to remain under a vegetation variance. The levee slopes and 15 to 20 feet landward of the levee would be permanently maintained free of trees and shrubs. Once construction is complete, the landside levees and easements would be maintained free of woody vegetation. This impact is **significant and unavoidable** because it would eliminate, in perpetuity, nearly all remaining landside trees and shrubs throughout the project footprint.

North Stockton
(Mosher Slough, Tenmile Slough, Fivemile Slough, Fourteenmile Slough)

Alternative 9b includes the same flood system improvements and vegetation impacts as Alternative 7a. Therefore, impacts to vegetation would be **significant and unavoidable** because there would be a permanent loss of riparian habitat wetlands and loss of natural communities and wildlife habitat.

Central Stockton
(Calaveras River, Smith Canal, Old Mormon Slough, SJR upstream of the Calaveras River to French Camp Slough and Duck Creek)

Alternative 9b proposes the same flood system improvements and would result in the same vegetation impacts, as Alternative 7a, except that there would be construction of a diversion structure at the confluence of Old Mormon Slough with the Stockton Diverting Canal and excavation within Old Mormon Slough in order to establish the channel as a flood bypass (Mormon Channel Bypass). Impacts to vegetation would

be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

Mormon Channel Bypass

A diversion structure would be constructed in the left bank of the SDC and floodflows (1,200 cfs every 2 years) would be reintroduced to Old Mormon Slough below its confluence with the SDC. Channel and existing road improvements and other infrastructure would require removal of a large number of trees and shrubs. Reintroducing flood flows to Old Mormon Slough and establishing the Mormon Channel Bypass would improve conditions for the remaining vegetation and would likely increase the health and encourage expansion of riparian vegetation along much of this channel. This impact would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

RD 17

Alternative 9b includes the same flood system improvements and vegetation impacts in RD 17 as Alternative 7b. These impacts would be **significant and unavoidable** because there would be a permanent loss of riparian habitat, including SRA and wetlands and loss of natural communities and wildlife habitat.

5.9.10 MITIGATION

Mitigation includes avoidance, minimization, remediation and compensation. Because construction would include establishment of compliance with the Vegetation ETL and also VFZ landside O&M easements, impacts to vegetation in the project footprint cannot be avoided, minimized or fully remediated. Compensatory mitigation would be used to mitigate for project impacts. Even with mitigation, implementation of Alternatives 7a, 7b, 8a, 8b, 9a and 9b would remain substantial and would result in permanent, **significant and unavoidable impacts**.

Avoid and Minimize

During the design refinement phase, plans would be evaluated to reduce the impact on vegetation to the extent practicable. Refinements could include reduction in the project footprint. USACE will also seek a vegetation variance in order to comply with the Vegetation ETL. Reciept of a variance would allow vegetation to remain on the lower two thirds of the waterside levee slope and within the waterside easement. In addition, if a variance is granted, USACE will seek opportunities to plant vegetation on the waterside of the levees in order to compensate for impacts to SRA habitat in accordance with the terms and conditions of the NMFS BO. The avoidance and minimization measures identified would be used to mitigate potential impacts to vegetation outside of the project footprint.

Install Exclusion Fencing along the Construction Work Area Perimeter and Implement General Measures to Avoid Effects on Sensitive Natural Communities and Special-Status Species

To clearly demarcate the project boundary and protect sensitive natural communities, temporary exclusion fencing would be installed around the project boundaries (including access roads, staging areas, etc.) 1 week prior to the start of construction activities. The temporary fencing would be continuously maintained until all construction activities were completed so that construction equipment would be confined to the designated work areas, including any off site mitigation areas and access thereto. The exclusion fencing would be removed only after construction for the year is entirely completed.

Exclusionary construction fencing and explanatory signage would be placed around the perimeter of sensitive vegetation communities that could be affected by construction activities throughout the period

during which such effects occur. Signage would explain the nature of the sensitive resource and warn that no effect on the community is allowed. Where feasible, the fencing would include a buffer zone of at least 20 feet between the resource and construction activities. All exclusionary fencing would be maintained in good condition throughout the construction period.

Conduct Mandatory Contractor/Worker Awareness Training for Construction Personnel

Before initiating any work in the project area, including grading, a qualified biologist would conduct mandatory contractor/worker awareness training for all construction personnel. It would be provided to brief them on the need to avoid effects on sensitive biological resources (e.g., riparian habitat, special-status species, wetlands and other sensitive biological communities) and the penalties for not complying with permit requirements. The biologist would inform all construction personnel about the life history of special-status species with potential for occurrence on the site, the importance of maintaining habitat and the terms and conditions of the BO or other authorizing document. Proof of this instruction would be submitted to USFWS and CDFW.

The training would also cover the restrictions and guidelines that must be followed by all construction personnel to reduce or avoid effects on sensitive biological communities and special-status species during project construction. The crew leader would be responsible for ensuring that crew members adhere to the guidelines and restrictions. Educational training would be conducted for new personnel as they are brought on the job. General restrictions and guidelines for vegetation and wildlife that must be followed by construction personnel are listed.

- Project-related vehicles would observe the posted speed limit on hard-surfaced roads and a 10-mile-per-hour speed limit on unpaved roads during travel in the project site.
- Project-related vehicles and construction equipment would restrict off-road travel to the designated construction area.
- To prevent possible resource damage from hazardous materials such as motor oil or gasoline, construction personnel would not service vehicles or construction equipment outside designated staging areas.

Retain a Biological Monitor

A qualified biologist would monitor construction activities adjacent to sensitive biological resources (e.g., special-status species, riparian habitat, wetlands, elderberry shrubs), as needed. The biologists would assist the construction crew, as needed, to comply with all project implementation restrictions and guidelines. In addition, the biologist would be responsible for ensuring that construction barriers fencing is maintained adjacent to sensitive biological resources.

Remediation

After construction, structural FRM features and easement areas would be reseeded with native grasses and herbs and/or planted with appropriate herbaceous riparian and wetland species.

Compensation

Vegetation impacts that cannot be mitigated through avoidance, minimization or remediation will be mitigated through compensation. A 14 acre mitigation site has been identified at the setback area in the Delta Front portion of the study area. This site would be planted with primarily VELB compensation (as discussed in Section 5.12) and associated riparian habitat. Additional compensation required for riparian, SRA, wetland and open water habitats would be accomplished through the purchase of credits at a

mitigation bank. More information regarding proposed compensation can be found in the Habitat Mitigation, Monitoring and Adaptive Management Plan (Environmental Addendum).

Where possible, on site mitigation areas would be the preferred action. USACE would seek opportunities to increase on site mitigation options during the design phase of the project, in accordance with the terms and conditions of the NMFS BO. Mitigation site selection would avoid areas where future disturbance or maintenance is likely. A revegetation plan would be prepared by a qualified biologist or landscape architect and reviewed by the appropriate agencies. The revegetation plan would specify the planting stock appropriate for each riparian cover type and each mitigation site, ensuring the use of genetic stock from the project area and would employ the most successful techniques available at the time of planting.

The plantings would be maintained and monitored, as necessary, for 3 to 5 years, including weed removal, irrigation and herbivory protection. USACE would submit annual monitoring reports of survival to the regulatory agencies including USFWS, NMFS and CDFW. Replanting would be necessary if success criteria are not met and replacement plants would subsequently be monitored and maintained to meet the success criteria. The mitigation would be considered successful when the plants meet the success criteria, the vegetation no longer requires active management and is arranged in groups that, when mature, replicate the area, natural structure and species composition of similar plant communities in the region.

5.10 WILDLIFE

This section describes the affected environment and environmental consequences relating to wildlife for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed. Note that special status wildlife species are discussed in Section 5.12, SPECIAL STATUS SPECIES.

5.10.1 ENVIRONMENTAL SETTING

Regulatory Framework

The laws, regulations and requirements that apply to wildlife are listed below and summarized in Chapter 7, Compliance with Applicable Laws, Policies and Plans.

Federal

- EO 13112 (Invasive Species)
- FWCA of 1934, as amended
- Migratory Bird Treaty Act of 1918

State

- CFGC

Local

- California Aquatic Invasive Species Management Plan, January 2008
- City of Lathrop General Plan (Polices 1, 2 and 7)
- San Joaquin County General Plan (Objective 1 and 2, Policies 1, 4, 5,6 and 8)
- San Joaquin County Multi-Species Habitat Conservation and Open Space Plan San Joaquin County Titles 9-1505 and 9-1510)
- Stockton General Plan 2035 (NCR-1 and NCR-2)

Existing Conditions

The project area is situated at an ecological crossroads between the habitats of the San Francisco Estuary and the riverine habitats of the San Joaquin Valley floor and the uplands from which SJR and tributaries flow. The project area extends from riverine areas along the lower SJR mainstem and its tributaries into the southeast portion of the Delta. Much of the project area is highly urbanized with urban development surrounded by agricultural lands that are primarily orchards, vineyards and row or field crops. Rice is also farmed in portions of the project area within the Delta. Upstream, State and Federal conservation lands provide habitat for a wider diversity of wildlife. The Caswell Memorial State Park is located near Manteca in San Joaquin County. The SJR National Wildlife Refuge is upstream along the mainstem of the SJR.

Terrestrial wildlife in the north and central Stockton area is comprised mainly of those species well-adapted to surviving at the urban-agriculture interface. In RD 17, the agricultural lands in the project area are more extensive. Common wildlife species are those typically associated with agriculture (alfalfa, row crops and orchard) and ruderal habitat (AECOM, 2011:3.6-14). Some larger stands of riparian forest in RD 17 provide habitat for a greater diversity of wildlife, including the Federally- protected Riparian Brush Rabbit. This species and other special status species are discussed in Section 5.12.

Efforts are underway through the Delta Stewardship Council's Delta Plan and the Bay Delta Conservation Plan, to conserve and restore extensive acres of habitat for fish and wildlife throughout the Delta, including near the project area.

Wildlife that are known or could reasonably be expected to occupy habitat in the project area are described below. The information in this section is drawn from AECOM (2011) and direct observations during reconnaissance visits.

Riparian Habitats

Riparian habitats are considered to be among the most productive and diverse wildlife habitats in California. Riparian habitats provide important nesting, resting and foraging for resident and migratory birds. They also provide critical ecological function as wildlife movement corridors. Riparian habitat is designated by CDFW as sensitive natural and provides high value to wildlife (ICF, 2013).

Species commonly found in Central Valley riparian habitat include: acorn woodpecker, black phoebe, Bullock's oriole, house wren, oak titmouse, western kingbird, western scrub-jay, yellow-rumped warbler and white egrets. Overstory trees may provide roost sites for tree-associated bat species and nest sites for raptors, such as Swainson's hawk (discussed further in Section 5.12), red-tailed hawk, white-tailed kite, red-shouldered hawk and great horned owl, as well as for l as herons and egrets. Overstory trees also provide suitable habitat for songbirds such as Bullock's oriole, yellow-rumped warbler, tree swallow and western scrub jay. Understory habitat provides cover for rodents, raccoons, opossum and striped skunk. Ground-nesting birds such as spotted towhee may forage among the vegetation and leaf litter. A few large patches of riparian forest with dense understory shrub layers are known to support riparian brush rabbit, which is

Federally-listed and State-listed as endangered (ICF, 2013; AECOM, 2011). Riparian habitats also provide cover and foraging habitat for reptiles and amphibians, such as terrestrial garter snake, gopher snake, Pacific tree frog and western toad.

Agricultural Lands

Agricultural lands in the project area include orchards, vineyards, row and field crops, alfalfa fields and rice. Ruderal species grow along the edges of fields and irrigation ditches, some of which contain water and associated aquatic plants. Row and field agricultural lands can provide high value foraging habitat for numerous resident and wintering raptors, songbirds, shorebirds and wading birds. Agricultural lands also provide foraging habitat for rodents, including deer mouse and California meadow vole; other mammals including coyote, raccoon, Virginia opossum; and reptiles, including gopher snake and terrestrial garter snake (ICF, 2013).

Orchard crops typically provide less value to wildlife but may be used for nesting or foraging by red-shouldered hawk, American crow, yellow-billed magpie, brown-headed cowbird, European starling, mourning dove and rock dove (ICF, 2013). Wildlife in agricultural ditches is typically limited because of the regular disturbance associated with maintenance activities and the absence of adjacent natural upland vegetation. Agricultural ditches, however, can support marsh-associated species, including birds such as marsh wren, sparrow species, white egret and mallard duck; amphibians such as Pacific chorus frog and bullfrog; and reptiles such as western pond turtle, which is a California species of special concern (Section 5.12).

Nonnative Annual Grasslands and Ruderal Lands

Grasslands in the project area are dominated by nonnative annual grasses and ruderal vegetation and may support stands of noxious weeds. Grassland generally occurs in disturbed areas, such as levee faces and edges of agricultural fields and roads. The annual grasslands in the project area contain a relatively large proportion of ruderal species, likely because of substantial disturbance from human activities.

Annual grasslands provide nesting and foraging habitat for several species of songbirds, including savanna sparrow, white-crowned sparrow and western meadowlark; and foraging habitat for several species of raptors, including red-tailed hawk and great-horned owl. Reptiles found in these habitats include California kingsnake, gopher snake and western rattlesnake. California ground squirrels commonly occur in annual grassland habitat (ICF, 2013).

Annual grasslands provide foraging habitat for numerous bat species and foraging and denning habitat for the American badger. Bird species for which annual grassland provides primary foraging and nesting habitat include northern harrier and western burrowing owl. Annual grassland also provides foraging habitat for raptor species, including Swainson's hawk and white-tailed kite. These grasslands also serve as primary foraging habitat for loggerhead shrike, grasshopper sparrow, purple martin, tricolored blackbird and yellow-headed blackbird. Ground squirrel burrows provide important nesting habitat for western burrowing owls. Additionally, annual grassland areas surrounding levees and those adjacent to aquatic habitat may provide potential winter hibernacula for the giant garter snake (GGS).

Developed Lands

Developed lands include levee roads and crowns, roads, railways, buildings and landscaped areas as well as areas that are disturbed and are not vegetated. These areas support relatively low wildlife diversity. Wildlife found in these areas are adapted to human disturbance and altered environments. These areas likely support common wildlife species, including house sparrow, house finch, European starling, American crow, mourning dove, raccoon, opossum, California ground squirrel and California meadow vole, to name a few.

Scattered landscape trees and shrubs associated with this area may provide nesting habitat for the above-listed common birds. Barren habitats provide primary habitat for the western burrowing owl, a special-status wildlife species that is discussed further in Section 5.12.

Open Water Areas

Open water in the project area includes the SJR, Fourteenmile Slough, Fivemile Slough, Tenmile Slough, Smith Canal, French Camp Slough (perennial drainages), agricultural ditches (ditches) and small artificial ponds (ponds). Open water provides breeding, foraging and migration habitat for numerous wildlife species. Mammal species commonly known to use perennial aquatic open water habitats include river otter, which uses these areas for foraging and escape cover and muskrat, which may use deepwater areas as migration corridors between suitable foraging areas. Open water areas also provide essential foraging habitat for wading birds, including great blue heron, great egret and snowy egret; numerous waterfowl species, including mallard, ruddy duck and bufflehead; other water birds, including eared grebe, double-crested cormorants and American white pelicans; and land birds, including black phoebe and belted kingfisher. These areas also provide rearing habitat, escape cover and foraging habitat for reptiles and amphibians, including common garter snake), bullfrog, Pacific tree frog and western toad. The vegetated areas below the ordinary high water mark provide nesting habitat for numerous songbirds, including red-winged blackbird and marsh wren and wading birds such as Virginia rail.

Emergent Wetlands

Emergent wetland vegetation occurs in agricultural ditches throughout the project area and along the margins of some parts of the SJR and its tributaries and associated sloughs. Emergent wetland provides important wildlife habitat value including nesting and foraging habitat for several songbirds, including red-winged blackbird and marsh wren; foraging and nesting habitat for Virginia rail; and foraging and cover habitat for the reptiles and amphibians mentioned above for open water.

Invasive Species

Invasive species are plants, animals or microbes that are not native to an environment and once introduced, establish, quickly reproduce and spread and cause harm to the environment, economy and/or human health. Invasive species threaten the diversity or abundance of native species through competition for resources, predation, parasitism, interbreeding with native populations, transmitting diseases or causing physical or chemical changes to the invaded habitat (CDFW, 2014). Both terrestrial and aquatic invasive species are potentially present in the project area. The American bullfrog and house sparrows are known to occur in the project area.

5.10.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This evaluation of wildlife is based on professional standards and information cited throughout the section. The key effects were identified and evaluated based on the environmental characteristics of the LSJR project area and the magnitude, intensity and duration of activities related to the construction and operation of this project.

Direct and indirect effects on wildlife species were quantitatively and qualitatively evaluated based on the potential for species occurrence in habitat located in the project area. Note that special status species are addressed in Section 5.12. Habitat was determined based upon a literature review, a two-day reconnaissance site visit and Google Earth. The project footprint was imported into Google Earth and vegetation cover was

identified and mapped. Acreages of direct effects were calculated for each alternative and are presented in separate tables. The analysis of potential indirect effects on wildlife is qualitative in nature (i.e., noise disturbance, dust accumulation) and was determined based on the proximity of project activities to know species locations or potential habitat. For wildlife movement, existing and accessible drainage corridors were qualitatively assessed with respect to their relative function to facilitate wildlife movement through the landscape.

Effect Assumptions

Assumptions regarding project effects on vegetation and wetlands (wildlife habitat) are discussed in Section 5.9, VEGETATION and Section 5.7, WETLANDS AND OTHER WATERS OF THE UNITED STATES. For wildlife, this additional assumption is made: Loss of agricultural and annual grassland vegetation would not be considered an adverse effect from a wildlife standpoint if the habitats are being converted to a higher value native habitat or to an equivalent value habitat. Because these habitats are common and not considered sensitive community types, the impacts may not be significant.

Effect Mechanisms

Wildlife resources could be directly and indirectly affected by and operation of the project alternatives. The following types of activities could cause varying degrees of effects on these resources.

Construction-Related Effects

- Vegetation removal for construction of levee improvements and other project features.
- Grading and fill placement during construction of levee alternatives.
- Channel dewatering or installation of temporary water-diversion structures.
- Temporary stockpiling and side-casting of soil, construction materials or other construction wastes.
- Short-term construction-related noise (from equipment).
- Soil compaction, dust and runoff.
- Runoff of herbicides, fertilizers, diesel fuel, gasoline, oil, raw concrete or other toxic materials used for levee construction, O&M into sensitive biological resource areas (e.g., riparian habitat, wetlands).
- Placement of rock slope protection on the landside of levees.

Post-Construction Effects

- O&M activities, including removal of weeds, shrubs and trees up to four times per year and reconditioning of levee slopes and road, as needed.
- Altering of hydrology.
- Toxicity associated with herbicides, insecticides and rodenticides.
- Increase habitat for native competitors or predators.
- Introduction of invasive nonnative species.

Basis of Significance

For this analysis, an environmental effect was considered potentially significant related to wildlife if it would result in any of the effects listed below. These effects are based on NEPA standards, State CEQA Guidelines Appendix G (14 CCR 15000 *et seq.*) and standards of professional practice.

- Substantial loss, degradation or fragmentation of any natural communities or wildlife habitat.
- Substantial interference with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors or impedance of the use of native wildlife nursery sites.
- Contribution to a substantial reduction or elimination of species diversity or abundance.
- Substantial effects on any riparian habitat or other sensitive natural community identified in local or regional plans, policies or regulations or by NMFS, USFWS or CDFW.
- Conflict with the Central Valley Flood Protection Plan (2012).
- Conflict with the provisions of the San Joaquin County Multi-species Conservation and Open Space Plan (2000).
- Conflict with the San Joaquin County General Plan, City of Stockton General Plan, Lathrop General Plan or the Manteca General Plan.

5.10.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, USACE would not participate in construction of the proposed project. There would be no construction-related affects to wildlife. However, the flood risk in the project area would remain elevated and flood fighting activities could be required. Wildlife habitats could be degraded or reduced due to erosion and flooding and wildlife swept away in the flood waters. The magnitude of the impacts would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.10.4 ALTERNATIVE 7A

Because vegetation cover is a general indicator of terrestrial habitat, the potential impacts to vegetation described in Section 5.9 provide a measure of impacts to wildlife. Vegetation would be removed from the construction footprint at the time each reach is constructed.

Potential impacts to wildlife would be similar throughout the project area. North and central Stockton and the northern and southern portions of RD 17 are developed urban areas adjacent to agricultural lands. Because this area is very urbanized, the primary effects to wildlife would be to avian species. Trees in the project area, including riparian trees on and adjacent to the levees, provide nesting habitat for many avian species in the area. Construction would likely occur from May through October when birds commonly nest in the area. These disturbances could cause nest abandonment and subsequent loss of eggs or developing young in the project area. All migratory birds and raptors are protected under the Migratory Bird Treaty Act (MBTA) and CFWC Sections 3503 and 3503.5.

Although urban lands do not provide high value wildlife habitat, some species are found in and adjacent to these areas. Common wildlife at the urban-agriculture interface includes birds, raccoons, possums, skunks and squirrels. Where riparian vegetation abuts agricultural lands, raptors may be common, along with jack rabbits and occasionally coyotes. Project construction and long-term O&M would result in **significant** short- and long-term affects to these species.

Short-term significant impacts to birds and other wildlife could be experienced in areas adjacent to the construction footprint but within the impact area for noise, vibration and dust. Potential conversion of agricultural land as a result of the proposed project would reduce foraging habitat for migratory birds. The proposed project would have short- and long-term impacts on resident and migratory birds because of the loss of nesting, resting and foraging habitat and impacts to commonly occurring wildlife. This is based upon the loss of migratory and movement corridors that would result from vegetation removal required for construction of structural flood risk reduction features, Vegetation ETL VFZ and maintenance of the O&M easement. Mitigation measures to avoid and minimize short-term construction impacts are described below. Compensatory mitigation measures to off-set impacts to habitat are described in Section 5.9, VEGETATION. Although mitigation would reduce short- and long-term impacts to wildlife, impacts would remain **significant and unavoidable**.

5.10.5 ALTERNATIVE 7B

Implementing Alternative 7b would result in impacts that are similar in type to, but greater in extent than, those described under Alternative 7a. This is because Alternative 7b includes the same features in north and central Stockton as for Alternative 7a, but also extents south to include northern, western and southern levees around RD 17. For the same reasons as described under Alternative 7a, short- and long-term impacts to wildlife would be **significant and unavoidable,** even when considering mitigation to avoid, minimize, rectify and compensate for impacts.

5.10.6 ALTERNATIVE 8A

Implementing Alternative 8a would result in impacts that are similar in type to, but greater in extent than, Alternative 7a. This is because Alternative 8a includes the same features as Alternative 7a, but also includes additional levee improvements on the Lower Calaveras River and along the Stockton Diverting Canal. For the same reasons as described under Alternative 7a, short- and long-term impacts to wildlife from implementing Alternative 8a would be **significant and unavoidable,** even with mitigation to avoid, minimize, rectify and compensate for impacts.

5.10.7 ALTERNATIVE 8B

Implementing Alternative 8b would result in impacts that are similar in type to, but greater in extent than, to those in Alternative 7b. This is because Alternative 8b includes the same features as Alternative 7b, but also includes additional levee improvements on the Lower Calaveras River and along the Stockton Diverting Canal. Like Alternative 7b, Alternative 8b includes levee improvements along northern, western and southern levees in RD 17. For the same reasons as described under Alternative 7a, short- and long-term impacts to wildlife from implementing Alternative 8b would be **significant and unavoidable,** even with mitigation to avoid, minimize rectify and compensate for impacts.

5.10.8 ALTERNATIVE 9A

Impacts to wildlife from implementing Alternative 9a would be the same as those described for Alternative 7a, except for the inclusion of channel excavation and related work required to restore flood flows to Old Mormon Slough. For the same reasons as described under Alternative 7a, short- and long-term impacts to wildlife from implementing Alternative 9a would be **significant and unavoidable,** even with mitigation to avoid, minimize, rectify and compensate for impacts.

5.10.9 ALTERNATIVE 9B

Impacts to wildlife from implementing Alternative 9b would be similar in type and extent to Alternative 7b. For the same reasons as described under Alternative 7a, short- and long-term impacts to wildlife from implementing Alternative 9b would be **significant and unavoidable,** for the same reasons as described under Alternative 7a, even with mitigation to avoid, minimize, rectify and compensate for impacts.

5.10.10 MITIGATION

The same mitigation measures apply to all of the action alternatives, although the amount of compensatory mitigation would vary based upon the amount and quality of habitat temporarily and permanently affected by the project. Measures to avoid potential impacts to special status species are described in Section 5.12 and would also benefit more common wildlife. Mitigation described in Section 5.9, VEGETATION, would also avoid, minimize, rectify and/or compensate for potential impacts to wildlife. If a vegetation variance was approved and some compensatory mitigation was accomplished on site, then short- and long-term impacts to wildlife habitat would be greatly reduced. However, because new plantings would take many years to establish, a temporal loss would remain. In addition, even with a vegetation variance, some areas that currently support trees and shrubs would be maintained permanently in herbaceous vegetation after construction. For these reasons, even if a vegetation variance were approved, impacts to wildlife would remain **significant and unavoidable**.

5.11 FISHERIES

This section describes the affected environment and environmental consequences to fisheries for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed.

5.11.1 ENVIRONMENTAL SETTING

Regulatory Framework

The following Federal and State laws and regulations apply to the resources covered in this chapter. Descriptions of the laws and regulations can be found in Chapter 7.

Federal

- CWA
- ESAMagnuson-Stevens Fishery Conservation and Management Act

State

- California ESA
- CFGC Section 1600: Streambed Alteration Agreements

Existing Conditions

North Stockton

The North Stockton sloughs provide fish spawning, rearing and/or migratory habitat for a diverse number of native, nonnative and special status species (Table 5-34). Many of the nonnative resident fish species are more tolerant of warm water, low dissolved oxygen and disturbed environments than native species as encountered in the North Stockton area during most of the year. In general, they are adapted to warm, slow-moving and nutrient-rich waters (Moyle, 2002).

Table 5-34: Fish Species Reported in the Study Area

Native Species	Introduced Species
hitch Lavinia exilicauda	American shad Alosa sapidissima
Blackfish Orthodon microlepidotus	threadfin shad Dorosoma petenense
San Joaquin roach Lavinia symmetricus sp.	goldfish Carassius auratus
Hardhead Mylopharodon conocephalus	red shiner Cyprinella lutrensis
Sacramento splittail Pogonichthys macrolepidotus	carp Cyprinus carpio
pikeminnow Ptychocheilus grandis	golden shiner Notemigonus chrysoleucas
Sacramento sucker Catostomus occidentalis	rosyface shiner Notropis rubellus
delta smelt Hypomesus transpacificus	fathead minnow Pimephales promelas
longfin smelt Spirinchus thaleichthys	white catfish Ameiurus catus
steelhead/rainbow trout Oncorhynchus mykiss	black bullhead Ameiurus melas
Chinook salmon Oncorhynchus tshawytscha	channel catfish Ictalurus punctatus
threespine stickleback Gasterosteus aculeatus	wakasagi Hypomesus nipponensis
prickly sculpin Cottus asper	western mosquitofish Gambusia affinis
tule perch Hysterocarpus traski	inland silverside Menidia beryllina
white sturgeon Acipenser transmontanus	striped bass Morone saxatilis
green sturgeon Acipenser medirostris	bluegill Lepomis macrochirus
river lamprey Lampetra ayresi	redear sunfish Lepomis microlophus
	smallmouth bass Micropterus dolomieu
	largemouth bass Micropterus salmoides
	white crappie Pomoxis annularis
	black crappie Pomoxis nigromaculatus
	bigscale logperch Percina macrolepida
	yellowfin goby Acanthogobius flavimanus
	Shimofuri goby Tridentiger bifasciatus
	chameleon goby Tridentiger trigonocephalus

Source: Moyle, 2002; data compiled by AECOM in 2010, in DEIS/DEIR Phase 3 of the RD 17 100-year Levee Seepage Area Project, Bio Resources, page 3.6-16.

Important attributes of the aquatic habitat within the SJR are aquatic vegetation and SRA habitat. Aquatic vegetation is represented by floating, submerged and emergent vegetation. 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 study area.

The USFWS defines SRA cover as "the zone of interface of water with the land margin, projected over the water to the maximum extent of overhead vegetation" (USFWS, 2014). The habitat value within the SRA cover zone varies with factors such as water depth, overhead cover from nearby riparian trees, instream cover elements such as wood, boulders and submerged vegetation and the type of aquatic substrate. SRA cover is considered essential habitat to a variety of fish species and is used as cover, forage, spawning and rearing habitat for fishes, both anadromous species and resident native and nonnative fishes (USFWS, 2014). In this nearshore aquatic zone, overhanging trees and shrubs provide shade which is important to the survival of many aquatic organisms, including fish. Overhanging vegetation moderates water temperatures, which is an important factor for various life stages of native fish species. The vegetation provides food and habitat for both terrestrial and aquatic invertebrates, which in turn serve as food for several fish species. Aquatic vegetation or in water cover, provides a diversity of microhabitats which allows for high species diversity, abundance and a food source for instream invertebrates, which in turn are eaten by several native fish species. Thus, a broad food base and extensive cover and habitat niches are supported by in-water cover. These values in turn create high fish diversity and abundance (USFWS, 1992).

The existing overhead shade cover within the study area varies by location and along each waterway. The amount of potential SRA overhead cover within the study area was calculated using aerial photography and determining which areas have overhanging vegetation and trees adjacent to the natural channel and which areas do not. Generally, greater shade cover occurs during summer when full tree canopies are present. Initial analysis of total lf (lf) of potential SRA was conducted using Google Earth Pro™ for the various reaches associated with ETL compliance in the study area.

Subsequent to release of the Draft FR/EIS/EIR, additional investigation and coordination with the NMFS's lead senior fisheries biologist responsible for the project area, resulted in the conclusion that the full suite of characteristics that comprise SRA are not present in Mosher, Fivemile, Fourteenmile and Tenmile sloughs and no SRA is actually present in these areas..

Central Stockton

SJR

The lower SJR serves as a migration corridor and/or provides other types of habitat (e.g., rearing, spawning) for two runs of Chinook salmon (i.e., fall-run and late fall run (*Oncorhynchus tshawytscha*), steelhead (*Oncorhynchus mykiss*), Delta smelt (*Hypomesus transpacificus*), Sacramento splittail (*Pogonichthys macrolepidotus*), white sturgeon (*Acipenser transmontanus*), green sturgeon (*Acipenser medirostris*) and numerous other resident native and nonnative species (Table 5-34) (AECOM, 2011).

In the project vicinity, the SJR is characterized as a wide channel (about 300 feet) with little riparian canopy or overhead vegetation and minimal bank cover. Aquatic habitat in the SJR is characterized primarily by slow moving glides and pools, is depositional in nature and has limited water clarity and habitat diversity. Altered flow regimes, FRM and bank protection efforts along much of the SJR reduced riparian vegetation and associated SRA habitat, sediment transport, channel migration, avulsion and large woody debris recruitment and isolated the channel from its floodplain. This resulted in a decline in habitat quality for fish species utilizing the SJR near the project. However, fish use this segment of the river even if only as a migratory pathway to and from upstream spawning and rearing areas (AECOM, 2011).

Calaveras River

The Calaveras River, a tributary to the SJR, is a relatively small, low elevation Central Valley drainage that receives runoff mainly from winter rainfall (CDFG, 1993). Flow in the Calaveras River is regulated by New Hogan Dam, located 38 miles upstream from the river's mouth at Stockton. New Hogan Reservoir has a storage capacity of 317,000 AF at gross pool and is operated by USACE for flood control, water supply and recreation. Rights to releases below New Hogan Dam are contracted for by the Stockton East Water District (SEWD) and the Calaveras County Water District through the Bureau of Reclamation (Stillwater Sciences, 2004).

The flow regime of the Calaveras River has been fundamentally altered since the 1930's when regulation of the Calaveras River began, first through Hogan Dam and subsequently through New Hogan Dam. Historically, the river's hydrology was characterized by highly variable flows during winter months and rapid attenuation of flows in the summer. Under current flow management, the variability and magnitude of winter flows is strongly reduced, while the magnitude and consistency of summer flows has increased dramatically. Water supplies stored in New Hogan Reservoir are transferred, via the Calaveras River, to downstream locations as far as the town of Bellota, where SEWD operates a municipal water supply diversion. The effect has been to transform the lower river from a more Mediterranean system, with high intra-year variability, to one that behaves like a typical snowmelt system, with fall and winter precipitation stored and released gradually in the summer months (Stillwater Sciences, 2004).

While little is known of the historical anadromous runs in the Calaveras River, currently fall Chinook salmon and steelhead (*Oncorhynchus mykiss*) enter the Calaveras River when suitable fall streamflows occur. The Calaveras River also supports a popular resident rainbow trout fishery. In 1998, the Central Valley steelhead Evolutionarily Significant Unit (ESU) was listed as "threatened" under the Federal (ESA by NOAA Fisheries (NMFS 1998). In June 2000, critical habitat was designated for Central Valley steelhead that included Calaveras River; however, this designation was later rescinded and critical habitat designation for Central Valley steelhead was subsequently redesignated on September 2, 2005, effective January 2, 2006 (70 FR 52488).

Stockton Diverting Canal

Currently, adult Chinook salmon and steelhead have two potential migration routes to access the Calaveras River upstream of Bellota Weir: 1) the Old Calaveras River channel downstream of Bellota and 2) Mormon Slough via the Stockton Diverting Canal. The majority of Chinook salmon and steelhead migrate through the Stockton Diverting Canal and Mormon Slough to access the mainstem Calaveras River, because this route typically receives higher flows than the Old Calaveras River channel. However, in many years, the timing and magnitude of stream flows below Bellota Weir are not sufficient to allow adult Chinook salmon and steelhead to migrate upstream into the high quality spawning and rearing habitat between Bellota and New Hogan Dam (USFWS, 1993). Additionally, numerous in-channel structures, natural hydraulic barriers and dry reaches along these migration routes create partial or complete migration barriers. For example, several hundred fall Chinook salmon were observed during the fall of 1995 at Bellota Dam, where they were temporarily blocked (CDFG, 1996).

Flow management and channelization activities have dramatically altered the sloughs and wetlands below Bellota Weir. These activities have probably reduced suitability of the lowest river reaches for salmonid rearing. For example, conditions that would not be expected to support significant numbers of rearing juveniles include: dewatering Old Calaveras River channel, complete lack of SRA habitat on the Stockton Diverting Canal and simplification and reduction of riparian cover on Mormon Slough.

RD 17

The SJR and the south bank of French Camp Slough comprise the RD 17 reach of the project area. Existing conditions for the RD 17 reach are the same as explained above for the Central Stockton reach.

5.11.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

Existing resource information related to the project area was reviewed to evaluate whether sensitive habitats and native fish species are known from or could occur in the study area. The information reviewed included the following sources: published and unpublished documents and reports pertaining to the study area; PICES Database by University of California; CNDDB; Endangered Species Database maintained by USFWS; and Superfund reference website, Environmental Protection Agency. Analysis of total SRA overhead cover in lf (lf) was conducted using Google Earth Pro™.

Basis of Significance

In general, effects on fish populations are significant when the project causes or contributes to substantial short or long-term reductions in abundance and distribution. An effect is found to be significant if it:

- Interferes 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;
- Has a substantial adverse effect, either directly or indirectly 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 CDFW or USFWS;
- Substantially reduces the habitat of a fish population;
- Causes a fish population to drop below self-sustaining levels;
- Threatens to eliminate an animal community.

5.11.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, no Federal action would be taken to reduce flooding. Risk to existing floodplain development would increase due to pressures presented by climate change, and seismic events. If flood events were to occur, there is a risk of possible levee failure due to seepage, slope instability, erosion and overtopping. The chance of overtopping increases with the challenges faced by sea level rise. Activities involved with flood fighting, levee protection and repair could cause harm to the fish populations found in the SJR system. Heavy equipment would be needed to move emergency supplies and personnel to locations along the levee system requiring emergency stabilization and repair. This heavy equipment has the potential to destroy riparian habitat used by organisms for cover and potential food sources. The chemicals, oil and fuel commonly used in this equipment could leak into the environment and the riverine system, causing injury or death to fish.

It is common to use large rocks and sand bags to shore up the levee system during flood events. This action has the potential to reduce habitat used by juvenile fish for protection from predators as they move downstream. In addition, the placement of and future removal of these items will potentially result in an increase in sediment introduction and turbidity which would have a negative effect on fish migration, spawning locations and reproductive success, as well as rearing habitats. Noise from all activities could cause migration patterns to change due to avoidance behavior, disrupting successful spawning events. Given the unpredictable nature of emergency activities, it is unlikely BMPs and other measures could be implemented to reduce negative effects to fish populations.

In the event of the levee being compromised by overtopping, seepage or loss of bank stability, there are additional risks associated with fish populations. Straying could occur, causing a portion of distinct genetic population segments of fish to be unable to reach historical spawning grounds. When flood waters recede, fish stranding is likely to take place by adults as well as juvenile fish, reducing these populations. Levee failure would allow for the introduction of pollutants into the system. Flooding in developed urban areas would introduce a number of household chemicals, oils, fuels, pharmaceuticals organic and inorganic pollutants. These substances have multiple ways of affecting fish populations, increasing risk for mortality. Agricultural land also presents the possibility for chemical and organic materials to enter the riverine system in the event of a levee breach. The use of herbicides, pesticides and fertilizers on soils is well known. All these chemicals have numerous ways in which they will interact in an aquatic environment, having negative impact to fish populations.

The magnitude of the impacts would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance

is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.11.4 ALTERNATIVE 7A

North Stockton

As described in Chapter 4, Alternative 7a would include the construction of levee remediation measures to address: (1) Under and through seepage, (2) restoration to USACE levee design criteria, (3) erosion, (4) geometry, (5) ETL VFZ requirements, (6) seismic stability and (7) FRM identified for Mosher Slough, Shima Tract, Fivemile Slough, Fourteenmile Slough and Tenmile Slough.

Construction activities, which include erosion protection, would be placed on the landside (in what is currently agricultural land) of Shima Tract, Fivemile Slough, Fourteenmile Slough and Tenmile Slough; this work would have no effect on existing waterside habitat conditions. Therefore, erosion protection construction would not affect resident native fish population abundance, movement and distribution. Increases in turbidity and suspended sediment associated with ground-disturbing activities are likely to extend beyond the immediate construction area and could result in short- to long-term effects of fish and aquatic resources depending on the effectiveness of the proposed erosion control measures. Under Alternative 7a, the proposed activities that are most likely to increase turbidity and sedimentation are those that disturb shoreline sediments or soils on the adjacent bank or levee where they can be carried by surface runoff to the river (e.g., clearing and grubbing of vegetation). Elevated concentrations of fine sediment and turbidity in the aquatic environment can have both direct and indirect effects on fish. The severity of these effects depends on the concentration and duration of exposure and the sensitivity of the species and life stage. Juvenile Chinook salmon, steelhead and green sturgeon are expected to be the most sensitive species and life stage in the project area.

For most activities, noise-related direct effects on fish would be limited to avoidance behavior in response to movements, noises and shadows caused by construction personnel and equipment operating in or adjacent to the water body. Resident fish would likely move upstream, downstream or laterally to an unaffected portion of the river in response to noise or disturbance and would therefore be unaffected.

The North Stockton reach would be required to establish compliance with the USACE Vegetation ETL, as explained in detail in Section 4.6; however, subsequent to release of the Draft FR/EIS/EIR, additional investigation and coordination with the NMFS's lead senior fisheries biologist responsible for the project area, resulted in the conclusion that the full suite of characteristics that comprise SRA are not present in Mosher, Fivemile, Fourteenmile and Tenmile sloughs and no SRA is actually present in these areas.

A permanent Consu on Fourteenmile Slough could have indirect effects on native fish populations due to an increase of predatory species attracted to structure and shade for hiding, increasing the predation on native fish species. During non-operational conditions, overwater and in water structures can alter underwater light conditions and provide potentially favorable holding conditions for adult fish, including species that prey on juvenile fishes. Permanent shading from the installation of piles and other structures in Fourteenmile Slough could increase the number of predatory fish (e.g., striped bass, largemouth bass) holding in the study area and their ability to prey on resident native fish species.

Construction design and sequencing of the closure structure would have in water habitat disturbance and affect SRA, resulting in short and long term impacts on fish, including the potential for entrainment during gate closure. Final design and operational strategies would be coordinated with the resource agencies to minimize or avoid long term effects on fish species in the project area.

Therefore, direct and indirect effects would be **significant and unavoidable** due to the permanent closure structure on Fourteenmile Slough, which could have indirect effects on native fish populations due to an increase of predatory species attracted to structure and shade for hiding, increasing the predation on native fish species and the potential for entrainment during gate closure.

Central Stockton

Construction effects would be the same as those described for the North Stockton reach except for the operation of the closure structure on Smith Canal and impacts due to SRA removal.

Construction and operational effects of the Smith Canal closure structure would be the same as those described above for the Fourteenmile Slough closure structure except for the duration and timing of gate closure. The purpose of the closure structure would be to cut off high water levels during high flow events. Operation of the closure structure would limit the water saturation levels in Smith Canal, which would reduce the risk of levee damage during flood events. The closure structure gates would be closed during high water levels on the SJR, typically during a flood event. Due to the tidal influence of the Delta region, there is the potential that these high water events could last from a few days to a few months, depending on river conditions. Construction design and sequencing of the closure structure would have in water habitat disturbance, affect SRA and result in short- and long-term impacts on fish including potential entrainment during gate closure. Final design and operational strategies would be coordinated with the resource agencies to minimize or avoid long-term effects on fish species in the project area.

The Central Stockton reach would also be required to establish compliance with USACE ETL vegetation requirements, as explained in detail in Section 4.7. A total of 19,630 lf of SRA habitat located on the Calaveras River, SJR, French Camp Slough and Duck Creek would be removed. Therefore, there would be significant direct effects by reducing the available areas for shade and possible food sources available to the existing native and nonnative fish species present in the study area. Direct and indirect effects due to loss of SRA habitat including potential entrainment during gate closure would be **significant and unavoidable** even with mitigation that included a variance to the Vegetation ETL and on-site compensation plantings. This is because of the temporal impacts that would occur between the time vegetation was removed and the time that new vegetation matured to a point that it provided off-setting ecosystem services. There would be permanent impacts where constructed FRM features preclude revegetation after construction is complete.

5.11.5 ALTERNATIVE 7B

Alternative 7b direct and indirect effects due to construction for the North Stockton and Central Stockton reaches would be the same as Alternative 7a, but would include levee remediation measures for RD 17.

RD 17

Construction effects for the RD 17 reach would be the same as those described above for Alternative 7a for the North Stockton Reach.

The RD 17 reach would be required to establish compliance with USACE vegetation requirements, as explained in detail in Section 4.6. Removal of 31,698 lf of SRA habitat located on the SJR and French Camp Slough would result in significant direct effects by reducing the available areas for shade and possible food sources available to the existing native and nonnative fish species present in the study area. Indirect effects to loss of SRA habitat would be **significant and unavoidable**.

5.11.6 ALTERNATIVE 8A

The Alternative 8a direct and indirect effects due to construction for the North Stockton and Central Stockton reaches would be the same as those described above for Alternative 7a except for an extension of levee remediation on the Calaveras River and levee remediation on the Stockton Diverting Canal.

The new levee construction on Duck Creek would involve 1,283 lf, of which 613 lf would be located next to the water of Duck Creek. There is no SRA habitat located here and water conditions would suggest nonnative fish species tolerant of high water temperatures and low dissolved oxygen would be the only species present.

This alternative would result in indirect effects due to loss of SRA habitat that would be **significant and unavoidable** even with mitigation that included a variance to the Vegetation ETL and on-site compensation plantings, because of the temporal impacts that would occur between the time vegetation was removed and the time that new vegetation matured to a point that it provided off-setting ecosystem services. There would be permanent impacts where constructed FRM features preclude revegetation after construction is complete.

5.11.7 ALTERNATIVE 8B

Alternative 8b direct and indirect effects due to construction for the North Stockton, Central Stockton and RD 17 reaches would be the same as Alternative 7b except for an extension of levee remediation on the Calaveras River and levee remediation on the Stockton Diverting Canal. Direct and indirect effects due to loss of SRA habitat would be **significant and unavoidable** even with mitigation that included a variance to the Vegetation ETL and on site compensation plantings, because of the temporal impacts that would occur between the time vegetation was removed and the time that new vegetation matured to a point that it provided off-setting ecosystem services. There would be permanent impacts where constructed FRM features preclude revegetation after construction is complete.

5.11.8 ALTERNATIVE 9A

The effects of Alternative 9a from construction and operation for the North Stockton and Central Stockton reaches would be the same as described for Alternative 7a. However, Alternative 9a includes the additional effects from the proposed Mormon Channel Control Structure and Bypass Channel.

The Mormon Channel measure consists of construction and operation of a control structure and channel improvements to allow for up to 1,200 cfs of flood flows to be diverted down this channel. The control structure includes a tainter gate that would be operated to divert water into the Mormon Channel during high water events. The gates would likely be operated every 2 years or so. The amount of water and duration of diverted flows would be adjusted according to the total flows moving through the system.

A FRM bypass system like this would likely only provide a corridor for migrating adult and juvenile fish, with no habitat for spawning or protection from predators. The 1,200 cfs could potentially be enough for attraction flows for fish migration up the Mormon Channel. Fish passage facilities located at the Stockton Diverting Canal could be considered in future planning. Due to the possibility of native and nonnative fish species in the Mormon Channel after a storm event, ramping down flows in the Mormon Channel so fish can escape to the main stem SJR before getting isolated in pockets and pools once flows are no longer being released would be implemented. Construction design and sequencing of the closure structure would have in water habitat disturbance and affect SRA, resulting in short and long term impacts on fish. Final design and operational strategies would be coordinated with the resource agencies to minimize or avoid long term effects on fish species in the project area.

Direct and indirect effects due to loss of SRA habitat would be **significant and unavoidable** even with mitigation that included a variance to the Vegetation ETL and on site compensation plantings. This is because of the temporal impacts that would occur between the time vegetation was removed and the time that new vegetation matured to a point that it provided off-setting ecosystem services. There would be permanent impacts where constructed FRM features preclude revegetation after construction is complete.

5.11.9 ALTERNATIVE 9B

The effects of Alternative 9b from construction and operation for the North Stockton, Central Stockton and RD 17 reaches would be the same as those described for Alternative 7b. Direct and indirect effects due to loss of SRA habitat would be **significant and unavoidable** even with mitigation that included a variance to the Vegetation ETL and on site compensation plantings, because of the temporal impacts that would occur between the time vegetation was removed and the time that new vegetation matured to a point that it provided off-setting ecosystem services. There would be permanent impacts where constructed FRM features preclude revegetation after construction is complete.

5.11.10 MITIGATION

Mitigation measures, including avoidance and minimization associated with SRA and riparian habitat, are addressed in VEGETATION (Section 5.9,) and WILDLIFE (Section 5.10), while measures with related BMPs associated with construction-related impacts such as dust, stormwater runoff and spills are addressed in WATER QUALITY (Section 5.5). Additional mitigation associated with impacts to fisheries is identified:

- In-water construction not associated with the closure structures would be restricted to the August 1 through November 30 work window, during periods of low fish abundance and outside the principal spawning and migration season. The typical construction season would generally correspond to the dry season, but construction may occur outside the limits of the dry season, only as allowed by applicable permit conditions.
- Due to the deleterious effects of numerous chemicals on native resident fish used in construction, if a hazardous materials spill does occur, a detailed analysis will be performed immediately by a registered environmental assessor or professional engineer to identify the likely cause and extent of contamination. This analysis will conform to American Society for Testing and Materials standards and will include recommendations for reducing or eliminating the source or mechanisms of contamination. Based on this analysis, USACE and its contractors would select and implement measures to control contamination, with a performance standard that surface water quality and groundwater quality must be returned to baseline conditions.
- During design feasibility studies for the operation and maintenance of the Mormon Channel bypass, the parameters would be to avoid or minimize stranding in the channel after flow events and flushing of upstream migrating adult fish down the channel from the Stockton Diverting Canal. Designs would include but not be limited to either an adult fish passage barrier at the confluence of the Stockton DWSC or for fish passage facilities at the Stockton Diverting Canal.

The following measures would be implemented during construction of the proposed Fourteenmile Slough and Smith Canal closure structures to reduce potential adverse effects on ESA listed species, other native fish species and their habitats.

- All in water construction activities would be limited to the period of June 1 through October 31 to avoid the primary migration periods of listed salmonids.
- In-water pile driving would be restricted to the period of July 1 through September 30 to avoid or minimize exposure of adults and juvenile salmonids to underwater pile-driving sounds.
- All pile driving would be conducted by a vibratory pile driver to minimize underwater sound levels during pile driving operations.
- Pile driving would be conducted by barge to minimize disturbance of riparian habitat.

While mitigation, including BMPs, would reduce effects on fisheries, impacts would nevertheless remain **significant and unavoidable** due to affects associated with vegetation removal and construction of the closure structures.

5.12 SPECIAL STATUS SPECIES

This section describes special status species that either occur or have the potential to occur in the project area that may be potentially impacted by the project.

5.12.1 ENVIRONMENTAL SETTING

Regulatory Framework

Federal

- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c)
- CWA
- Federal ESA (16 U.S.C. 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act (16 U.S.C. §703-712)

State

- California ESA (Fish and Game Code 2050 et seq.)
- CFGC Section 1600: Streambed Alteration Agreements
- California Native Plant Protection Act (Fish and Game Code 1900 et seq.)

Existing Conditions

Information on special status species that may be affected was gathered from various sources:

- USFWS online services species list (USFWS, accessed on 23 April 2014);
- CDFW's CNDDB (CDFG, 2014);
- California Native Plant Society's (California Native Plant Society, 2014) online Inventory of Rare and Endangered Vascular Plants of California (California Native Plant Society).

Each database query for special-status species was based on a search of the USGS 7.5' quadrangles on which the study area is located (i.e., Waterloo [478C]), Lodi South [479D], Stockton East [461B], Stockton West [462A], Lathrop [462D], Manteca [461C]. The resulting USFWS queries, as well as the lists generated by the CNDDB and CNPS searches, are included in the Environmental Addendum. All lists were reviewed and habitat preferences for each species were compared with the affected areas and project site description. Those special status species known to occur or with suitable habitat, in or near the project area, are identified in Table 5-35 and discussed in detail below.

Certain special status species and their habitats are protected by Federal, State or local laws and agency regulations. The Federal ESA of 1973 (50 CFR 17) provides legal protection for plant and animal species in danger of extinction and is administered by USFWS and NMFS. The California ESA of 1977 parallels the Federal ESA and is administered by CDFW. Other special status species lack legal protection, but have been characterized as "sensitive" based on policies and expertise of agencies or private organizations or policies adopted by local government. Special-status species are those that meet any of the following criteria:

- Listed or candidate for listing under the Federal ESA (50 CFR 17);
- Listed or candidate for listing under California ESA;
- Nesting bird species and active nests of birds listed under the Migratory Bird Treaty Act;
- Species listed in the Bald and Golden Eagle Protection Act;
- Essential Fish Habitat (EFH) listed under the Magnuson-Stevens Act;
- Fully protected or protected species under stated CDFW code;
- Wildlife species of special concern listed by the CDFW;
- Plant species listed as Rare under the California Native Plant Protection Act;
- Plant species listed by the California Native Plant Society; and
- Species protected by other local ordinances, goals and policies.

Lists of special status species and candidate species were found on the USFWS website and the CNDDB. The USFWS and CNDDB lists are included in the Environmental Addendum and are summarized in Table 5-35.

Table 5-35: Special Status Species and Critical Habitats

Species/Critical Habitat	Status[1]	Potential to Occur[2]
INVERTEBRATES		
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Federal: T	**May occur**; elderberry shrubs present occasionally along SJR on the waterside and landside of the project area
Vernal pool fairy shrimp *Branchinecta lynchi*	Federal: T	**Unlikely to occur** No known habitat in the project area. No NDDB records in the project area.
Vernal pool tadpool shrimp *Lepidurus pachardi*	Federal: T	**Unlikely to occur** No known habitat in the project area. No NDDB records in project area.
AMPHIBIANS		
California Tiger Salamander *Ambystoma californiense*	Federal: T CA: T	**Unlikely to occur**; potential aquatic habitat is limited to one constructed pond in RD 17, likely with predatory fish; a small area of fresh water marsh and agricultural ditches. A 1996 CNDDB record documents California tiger salamander adjacent to Hwy 120 in roadside seasonal wetland, however, it is two miles east of the SJR and geographically isolated.
California red-legged frog *Rana draytonii*	Federal: T CA: T	**Unlikely to occur** No CNDDB records in project area.

REPTILES

Giant garter snake *Thamnophis gigas*	Federal: T CA: SSC	**May occur**; suitable habitat is present in backwater areas of the adjacent SJR and in agricultural ditches with permanent water. The CNDDB listed one occurrence of GGS within the Central Stockton project area in the Stockton Diverting Canal.
Western pond turtle *Actinemys marmorata*	CA: SSC	**May occur**; suitable habitat is present in backwater areas of the adjacent SJR and in agricultural ditches with permanent water.

MAMMALS

Riparian brush rabbit *Sylvilagus bachmani riparius*	Federal: E State: E	**Known to occur**; occupied riparian habitat is present on the waterside of and suitable habitat is present immediately adjacent to the project area in several elements; species is also known to occur at an oxbow of RD 17.
Western mastiff bat *Eumops perotis californicus*	State: SSC	**May occur**; suitable foraging habitat present, but no potential roost sites.
Red bat *Lasiurus blossevillii*	State: SSC	**May occur**; suitable foraging and roosting habitat present.

BIRDS

Tricolored Blackbird *Agelaius tricolor*	State: SSC	**May occur**; foraging habitat present in small areas of freshwater marsh and riparian habitat. Five occurrences have been documented within the RD 17 project area. Five occurrences exist within the project footprint at RD 17. One occurrence exists south of Howard road one-half mile east of the project area. Two occurrences exist one-half mile west of Interstate 5 and the SJR. Two additional occurrences exist at the southern end of the project area more than one mile away.
Burrowing owl *Athene cunicularia*	State: SSC	**May occur**; suitable foraging and nesting habitat present; One burrowing owl occurrence is present at Mosher Slough. Two burrowing owl occurrences are present at a railyard facility three-quarter mile east of the project area. Five burrowing owl occurrences are present at in the northern project area of RD 17 in a residential development of the Taft

		Mosswood area. The occurrences are one-half mile from the project area at the SJR, Old Mormon Slough and Developable Lands (RD 17).
Swainson's hawk *Buteo swainsoni*	State: T	**Known to occur**; suitable foraging habitat and nesting habitat present in and adjacent to the project area. Six occurrences have been documented within the Delta Front/North Stockton project area. Two occurrences exist within the project footprint at Mosher Slough and Calaveras-Right. One occurrence exists at Calaveras-Right within 0 to 100 feet of the project area. Two occurrences exist within 101-500 feet from the project at Mosher Slough at Shima Tract and Calaveras-Right. Three occurrences exist within 501 feet to .5 miles at Shima Tract, Fourteenmile Slough Dry Land Levee and Calaveras-Right. Eight occurrences have been documented within the Central Stockton project area. Three occurrences exist within the project footprint at SJR Mile, French Camp Slough and Duck Creek. One occurrence exists within 101-500 feet from the project area at Calaveras-Left. Four occurrences exist within 501 feet to .5 miles at Calaveras Left, SJR and Smith Canal. Eight occurrences have been documented within the RD 17 Area. Four occurrences exist within the project footprint at French Camp Slough-Left, SJR Mile X and Y and the Developable Lands. Three occurrences exist within 0 feet to 100 feet at SJR RD 17 and Old Mormon Slough. Three occurrences exist within 101-500 feet at SJR RD 17 and Old Mormon Slough. Six occurrences exist within 501 feet to 0.5 miles at French Camp Slough-Left, SJR Mile (4) and Old Mormon Slough.
White-tailed kite *Elanus leucurus*	State: FP	**May occur**; suitable foraging and nesting habitat present in and adjacent to the project area
Song sparrow ("Modesto" population) *Melospiza melodia*	State: SSC	**May occur**; suitable foraging and nesting habitat present in and adjacent to the project area
Least Bell's vireo *Vireo bellii pusillus*	Federal: E State: E	**May occur**; suitable foraging and nesting habitat present in and adjacent to the project area - Riparian forest, Riparian scrub, Riparian woodland.
Yellow-headed blackbird *Xanthocephalus*	State: SSC	**May occur**; Three occurrences have been documented within the RD 17 southern project area. One occurrence exists within 501 feet to .5 miles. Two occurrence exist within >.5 miles and <1 mile.
PLANTS		

Alkali milk-vetch *Astragalus tener*	CNPS: 1B.2	**May occur**; 2 accounts – one on project site, the other within 100-500 feet of the project site within Central Stockton. Recorded as extirpated.
Heartscale *Atriplex cordulata var. cordulata*	CNPS: 1B.2	**Unlikely to occur**; found in saline or alkaline soils in chenopod scrub, meadows and seeps, sandy areas in valley and foothill grassland.
San Joaquin spearscale *Atriplex joaquinana*	CNPS: 1B.2	**Unlikely to occur;** found in alkaline soils in chenopod scrub, meadows and seeps, playas, valley and foothill grassland.
Round-leavd filaree *California Macrophylla*	CNPS: 1B.1	**Unlikely to occur;** Clay soils in cismontane woodland, valley and foothill grassland.
Owl's clover *Castilleja campestris* ssp. succulent	Federal: T State: E	**Unlikely to occur;** (hemiparasitic) on the roots of other plants. It occurs on the margins of vernal pools, swales and some seasonal wetlands, often on acidic soils. It is never dominant and it is found in only a few of the pools in an area. Known to occur in adjacent quad north of project.
Slough thistle *Cirsium crassicaule*	CNPS: 2	**May occur**; 3 on site accounts in RD 17. Chenopod scrub, marshes and swamps (sloughs), riparian scrub.
Big tarplant *Blepharizonia plumose*	CNPS: 1B.1	**May occur**; Big tarplant occurs in annual grassland on clay to clay-loam soils, usually on slopes and often in burned areas, below 1,500 feet 2 accounts – one on project site, the other within 100-500 feet of the project site at Old Mormon Slough. Recorded as extirpated.
Watershield *Brasenia schreberi*	CNPS: 2B.3	**Unlikely to occur**; Water Shield is an aquatic plant with slender, branching stems. The Leaves are entire, floating, oval to elliptic in shape, green above, often purple beneath, long-stemmed and have the stalk or petiole attached.
Palmate-bracted bird's-beak *Chloropyron palmatum*	Federal: E State: E	**Unlikely to occur**; Alkaline grassland, alkali meadow, chenopod scrub;

Delta button celery *Eryngium racemosum*	CNPS: 1B State: E	**Unlikely to occur**; in low-quality irrigation ditch and freshwater marsh habitat; 1892 and 1913 herbarium records are only source of occurrences (near SJR and I-5 crossing); thought to be possibly extirpated
Rose mallow *Hibiscus lasiocarpus*	CNPS: 2	**May occur**; 2 accounts in Delta Front/North Stockton, one in Central Stockton. Native to riparian areas around the Sacramento River in California and can also be found in other states. Grows in moist soil near the river
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	CNPS: 1B	**May occur**; 3 accounts in Central Stockton within 100 to 500 feet of project area. Freshwater and brackish marshes and swamps.
Mason's lilaeopsis *Lilaeopsis masonii*	CNPS: 1B State: R	**May occur**; 3 accounts in Delta Front/North Stockton Riparian scrub, brackish or freshwater marshes and swamps.
Delta mudwort *Limosella subulata*	CNPS: 2	**Unlikely to occur**; Marshes and swamps.
Sanford's arrowhead *Sagittaria sanfordii*	CNPS: 1B	**Unlikely to occur**; Freshwater marshes, sloughs, canals and other slow-moving water habitats.
Suisun marsh aster *Symphyotrichum lentum*	CNPS: 1B	**Unlikely to occur**; 1892 (near City of Lathrop) and 1920 (near town of Banta) herbarium records are only source of occurrences. Brackish and freshwater marshes and swamps.
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	CNPS: 2	**Unlikely to occur**; Herbarium records from 1892 to 1914 are only source of occurrences (near SJR and I-5 crossing) On alkaline soils in floodplains, meadows and seeps, marshes and swamps, riparian forest, vernal pools.

FISH

Central Valley steelhead *Oncorhyncus mykiss*	Federal: T State: **	**May occur**; Occurs in the Sacramento and SJRs, tributaries and Delta. Occurs seasonally in the SJR in the project vicinity.
Central Valley fall-/late fall -run Chinook salmon *Oncorhyncus tshawytscha*	Federal: SC State: SSC	**May occur**; Occurs in the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.
Sacramento River winter-run Chinook salmon *Oncorhyncus tshawytscha*	Federal: E State: E	**Unlikely to occur**; Occurs in the Sacramento River, tributaries and Delta. Considered but not included due to only potential presence lower down at the confluence of the San Joaquin and Sacramento Rivers. No presence expected in the action area.
Central Valley spring-run Chinook salmon *Oncorhyncus tshawytscha*	Federal: T State: T	**Unlikely to occur**; Occurs in the Sacramento River, tributaries and Delta. Considered but not included due to extirpation on the SJR.
Green sturgeon *Acipenser medirostris*	Federal: T State: **	**May occur;** Occurs in the Sacramento River and San Joaquin, Sacramento River Delta. Has the potential to occur in the SJR in the project vicinity.
Delta smelt *Hypomesus transpacificus*	Federal: T State: T	**May occur**; Occurs in tidally influenced segments of the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.
Longfin smelt *Spirinchus thaleichthys*	Federal: ** State: T	**Unlikely to occur**; Occurs in tidally influenced segments of the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.
Sacramento splittail *Pogonichthys macrolepidotus*	Federal: DT State: SSC	**Unlikely to occur**; Occurs in the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.
Hardhead *Mylopharodon conocephalus*	Federal: ** State: SSC	**Unlikely to occur**; Occurs in the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.

San Joaquin roach *Lavinia symmetricus sp.*	Federal: ** State: SSC	**Unlikely to occur**; Occurs in tributaries to the Sacramento and SJRs. Not likely to occur in the SJR in the project vicinity.
[1]**Legal Status Definitions:** **Federal Listing Categories (USFWS & NMFS)** E - Endangered (legally protected) T - Threatened (legally protected) DT - Delisted from threatened status SC - Species of Concern		**State Listing Categories (CDFW)** E - Endangered (legally protected) T - Threatened (legally protected) SSC - California Species of Special Concern (no formal protection)
Source: CNDDB, 2014, USFWS and NMFS 2014 and AECOM 2011 [2] This table focuses on known or potential presence within and adjacent to, the construction footprint for the structural FRM features.		

5.12.1.1 Special Status Wildlife Species

Of the special status wildlife species identified in Table 5-35, only 10 potentially occur in the project area.

Valley Elderberry Longhorn Beetle

Status. The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) is Federally-listed as threatened. The species has no State status (the State of California does not list insects).

Distribution and Habitat. The VELB is endemic to the Central Valley and is found in riparian habitats and associated uplands where the elderberry (*sambucus* spp.), the beetle's food plant, grows. The beetle is a pith-boring species that depends on elderberry plants during its entire life cycle. Larvae feed on tree pith, while adults eat the foliage and possibly the flowers of the plants. The adult stage of the VELB is short-lived, and most of the life cycle is spent in the larval stage. Eggs are laid singly or in small groups, in crevices in elderberry bark and hatch in about 10 days. Larvae bore into the pith of elderberry roots, branches, and trunks to create an opening in the stem within which they pupate, remaining in this stage for one to two years before emerging as adults. After metamorphosing into an adult, the VELB chews a circular exit hole through which it emerges, sometime during the period of late March to June. The adults are active from early March through early June with mating occurring in May. It has been suggested that the VELB is a poor disperser, based on the spatial distribution of occupied shrubs (USFWS, 1997).

Potential for Occurrence in Project Area. Elderberry shrubs are known to occur along the SJR, on both the waterside and landside of levees. Subsequent to releasing the Draft FR/EIS/EIR, a protocol-level field survey was completed within the Alternative 7a project area. Results are described below.

North Stockton

During a protocol-level field survey within the Alternative 7a project area. This survey identified 8 elderberry shrubs (0 nonriparian and 8 riparian) within the Alternative 7a North Stockton project area. Refer to Table 5-36 for quantities. The surveys were conducted in accordance with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999). All elderberry shrubs with the potential to be affected by project activities have been mapped and surveyed to determine the size of the stems on each shrub, location of shrubs to riparian habitat and presence of exit holes.

Central Stockton

During a protocol-level field survey within the Alternative 7a project area. This survey identified 36 elderberry shrubs (28 nonriparian and 8 riparian) within the Alternative 7a Central Stockton project area. Refer to Table 5-36 for quantities. The surveys were conducted in accordance with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999). All elderberry shrubs with the potential to be affected by project activities have been mapped and surveyed to determine the size of the stems on each shrub, location of shrubs to riparian habitat and presence of exit holes.

RD 17 Area

A total of 25 elderberry shrubs were observed within 100 feet of the RD 17 Levee Stability Program, Phase 3 Project Area, including 16 shrubs on the waterside of the levee and 9 shrubs on the landside of the levee. None of the shrubs had evidence of adult beetle exit holes (USACE, 2011).

Giant Garter Snake

Status. The GGS (*Thamnophis gigas*) is Federal and State-listed as threatened.

Distribution and Habitat. The GGS is endemic to wetlands in the Sacramento and San Joaquin valleys (Hansen and Brode, 1980). The current distribution extends from near Chico in Butte County south to the Mendota Wildlife Area in Fresno County. No occurrences of GGS are known from the northern portion of the San Joaquin Valley to the eastern fringe of the Sacramento-SJR Delta, where the floodplain of the SJR is limited to a relatively narrow trough (Hansen and Brode, 1980, 58 FR 54053). The resulting gap of 60 miles separates the southern and northern populations (Hansen and Brode, 1980, CNDDB, 2011).

Rice fields and their adjacent irrigation and drainage canals and ditches, serve an important role as aquatic habitat for the snakes. During the summer, some snakes use the flooded rice fields as long as their prey is present in sufficient densities. In late summer, rice fields provide important nursery areas for newborns. In late summer/fall, water is drained from the rice fields and the snakes become concentrated in the remaining pockets of standing water, which allow the snakes to gorge on remaining prey before the winter, their period of winter inactivity (USFWS, 1999). It appears that the majority of the snakes move back into the canals and ditches as the rice fields are drained, although a few may overwinter in the fallow fields where they hibernate within burrows in the small berms separating the rice checks (Hansen, 1998).

Potential for Occurrence in Project Area. Suitable habitat within the project area is present. Numerous sloughs, canals, low gradient streams and freshwater marsh habitats and irrigation ditches exist where a prey base of small fish and amphibians are present. Grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter is present. One occurrence in project area has been recorded.

North Stockton

No occurrences.

Central Stockton

The CNDDB listed one occurrence of GGS within the Central Stockton project area in the Stockton Diverting Canal.

RD 17 Area

No occurrences.

Western Pond Turtle

Status. The western pond turtle (*Emys marmorata*) is a California Species of Special Concern.

Distribution and Habitat. The western pond turtle is found west of the Sierra-Cascade crest from western Washington to northwest Baja California (Stebbins, 2003). Western pond turtles inhabit fresh or brackish water habitats characterized by areas of deep water, low flow velocities, moderate amounts of riparian vegetation, warm water and/or ample basking sites and underwater cover elements such as large woody debris and rocks. Along major rivers, western pond turtles are often concentrated in areas of optimal habitat, often in side channel and backwater areas. Turtles may move to off-channel habitats, such as oxbows, during periods of high flows (Holland, 1994).

Although adults are habitat generalists, hatchlings and juveniles require very specialized habitat for survival through their first few years. Hatchlings spend much of their time feeding in shallow water with dense, submergent or short emergent vegetation (Jennings and Hayes, 1994). Habitats preferred by juveniles are relatively scarce and subject to disturbance (Jennings et al., 1992). Although an aquatic reptile, western pond turtles spend time on land basking, overwintering and nesting, up to 1 km (0.6 mi) away from aquatic habitats (Holland, 1994).

Western pond turtle eggs are typically laid in June and July, though may be laid as early as late April and as late as August (Holland, 1994). Nests are generally located in grassy meadows, away from trees and shrubs (Holland, 1994), with canopy cover commonly less than 10 percent. Incubating eggs are extremely sensitive to increased soil moisture that can cause high mortality. Egg-laying sites vary from sandy shoreline to forest soil. Young hatch in late fall or overwinter in the nest and emerge in early spring.

Although considered to be just 1 widely distributed species, it is likely that the pond turtle is a complex of closely related subspecies, each adapted for a different region. The western pond turtle is still common enough in the Delta watershed so that it is not difficult to find them in habitats ranging from sloughs of the Delta and Suisun Marsh, to pools in small streams. The problem is that the ones most seen are large, old individuals; hatchlings and small turtles are increasingly rare. The causes of the poor reproductive success are not well understood, but factors that need to be considered include elimination of suitable breeding sites, predation on hatchlings by nonnative predators (e.g., largemouth bass, bullfrogs), predation on eggs by nonnative wild pigs, diseases introduced by nonnative turtles and shortage of safe upland over-wintering refuges. If present trends continue, the western pond turtle will deserve listing as a threatened species (it may already) (CALFED, 2000).

Potential for Occurrence in the Project Area. The CNDDB does not list occurrences of western pond turtle in the project areas. However, suitable habitat is present in the backwater areas of the adjacent SJR and agricultural ditches with permanent water.

Riparian Brush Rabbit

Status. Riparian brush rabbit (*Sylvilagus bachmani*) is Federally-listed and State-listed as endangered.

Distribution and Habitat. Riparian brush rabbit occupies relatively large patches in riparian forests with a dense understory shrub layer. This species is closely tied to brushy cover and rarely moves more than a meter from cover. They will not cross large, open areas, which limits their dispersal capabilities (USFWS, 1998) and this inability to disperse beyond the dense brush makes them susceptible to mortality during flood events (USFWS, 1998; Williams, 1988). The primary threat to their survival is the limited extent of its existing habitat, extremely low numbers of individual animals and few extant populations.

Historically, riparian brush rabbits inhabited dense, brushy areas of Valley riparian forests, marked by extensive thickets of wild rose, blackberries and willows (Sandoval et al., 2006). Suitable habitat for riparian brush rabbits is characterized by an abundance of woody ground litter, mats of low-growing vines and shrubs and areas of higher ground not subject to regular or heavy flooding (Sandoval et al., 2006). Riparian brush rabbits forage along the edges of shrub cover and in small clearings in the vegetation cover rather than in large openings, feeding on herbaceous vegetation such as grasses, sedges, clover, forbs and buds, bark and leaves of woody plants (Sandoval et al. 2006; USFWS, 1998). This species has a small home range and mainly remains hidden under protective shrub cover, seldom venturing more than 1 meter (3.3 ft) from cover (Sandoval et al., 2006).

Potential for Occurrence in the Project Area. Suitable riparian brush rabbit habitat exists with the project area. Pockets of riparian plant communities with shrub cover and in small clearings could provide suitable habitat. The species is currently restricted to several populations at Caswell Memorial State Park, near Manteca in San Joaquin County; along the Stanislaus River; on private lands adjacent to the SJR National Wildlife Refuge (Williams, 1993; Williams and Basey, 1986); along Paradise Cut, a channel of the SJR; on an oxbow along the SJR within RD 17 jurisdiction edges of shrub cover and in small clearings in the vegetation cover. The Riparian Brush rabbit does not occur in the North or Central Stockton reaches.

RD 17 Area

Documented occurrences of riparian brush rabbit within RD 17 exist. A managed preserve for brush rabbits was established in 2004. The SJR Oxbow Preserve is a 30 acre riparian forest preserve located adjacent to the SJR within the city of Lathrop, in San Joaquin County. The preserve was created in 2004 by Union Pacific Homes as mitigation for their development in the city of Lathrop (CNLM, 2014).

Western Red Bat

Status. The western red bat (*Lasiurus blossevillii*) is a California Species of Special Concern.

Distribution and Habitat. Western red bats have been observed near the Pacific Coast, Central Valley and the Sierra Nevada. Usually found at lower elevations, recent acoustic surveys in California have documented that western red bats, while relatively rare, are broadly distributed at elevations up to 8,202 feet in the Sierra Nevada (Pierson et al., 2000, 2001; Pierson and Rainey, 2003). They have often been observed in edge habitats—near streams, fields orchards or urban areas (Zeiner et al., 1990b). This species roosts non-colonially in dense canopies and within tree foliage, beneath overhanging leaves (Constantine, 1959, Shump and Shump, 1982), from 2 to 40 feet above ground level (Zeiner et al., 1990b). Studies in the Central Valley found that summering populations of red bats are substantially more abundant in remnant riparian stands of cottonwood or sycamore greater than 164 feet wide, than in younger, less extensive stands (Pierson et al. 2000).

Western red bats may forage up to 0.3 to 0.6 of a mile from their day roost (Zeiner, 1990b) at both canopy height and low over the ground (Shump and Shump, 1982). This species feeds primarily on small moths but its diet may include a variety of other insects such as crickets, beetles and cicadas (Zeiner et al., 1990b).

Western red bats mate in August and September. Breeding females have the same cover requirements as for other roost sites and with cottonwood/sycamore riparian habitat along large river drainages in the Central Valley (Ziener et al., 1990b, Pierson and Rainey, 2003). Fertilization is delayed until March or April. After an 80-to 90-day gestation period, pups are born from late May through early July.

Potential for Occurrence in the Project Area. Western red bats may roost near the study area in trees and may forage in the nearby fields. CNDDB states that suitable foraging and roosting habitat is present and the species potentially could occur.

Western mastiff bat

Status. The western mastiff bat (*Eumops perotis californicus*) is a California Species of Special Concern.

Distribution and Habitat. Occurs along the western Sierra primarily at low to mid-elevations and widely distributed throughout the southern Coast Ranges. Recent surveys have detected the species north to the Oregon border. Found in a wide variety of habitats from desert scrub to montane conifer. Roosts and breeds in deep, narrow rock crevices but also may use crevices in trees, buildings and tunnels. Uncommon in the Central Valley and roost sites primarily associated with crevices in cliff faces and boulders.

Potential for Occurrence in the Project Area. No occurrences were recorded within 5 miles of the affected area. CNDDB states that suitable foraging is present but roosting habitat is not. The species potentially could occur.

Burrowing Owl

Status. The burrowing owl (*Athene cunicularia*) is California state species of concern.

Distribution and Habitat. Burrowing owls historically ranged throughout the Central Valley, in suitable habitat in coastal areas from Marin County to the Mexican border, and in lower numbers in desert areas of the northeastern and southeastern portions of California. Throughout the vast majority of the burrowing owl's range, breeding owls persist in only small, declining populations that are highly susceptible to extirpation.

Western burrowing owls prefer open grasslands and shrublands with perches and burrows. They usually live and nest in the old burrows of California ground squirrels or other small mammals (Zeiner et al., 1990), but also can nest in piles of wood or other debris. Burrows can be found on the sides of hills, along roadside embankments, on levees, along irrigation canals, near fence lines and on or near other raised areas of land. The breeding season for burrowing owls extends from February 1 through August 31 (CDFG, 2012). Burrowing owls tend to be opportunistic feeders, with large arthropods, mainly beetles and grasshoppers, comprising a large portion of their diet. The species is primarily crepuscular (active at dusk and dawn) but will hunt throughout a 24-hour period.

Potential for Occurrence in the Project Area. Borrowing owls may have the potential to occur on the project site. According to the CNDDB, suitable foraging and nesting habitat is present in the project area.

North Stockton

One burrowing owl occurrence is present at Mosher Slough.

Central Stockton

Two burrowing owl occurrences are present at a railyard facility 0.75 miles east of the project area.

RD 17 Area

Five burrowing owl occurrences are present in the northern portion of RD 17 in the Weston Ranch residential development of the Taft Mosswood area. The closest occurrence to the RD 17 levee on the SJR is about 0.2 miles to the east. The closest occurrence to the French Camp Slough levee in RD 17 is about 1.5 miles to the south of the levee.

Swainson's Hawk

Status. Swainson's hawk (*Buteo swainsoni*) is State-listed as threatened.

Distribution and Habitat. In the Central Valley, Swainson's hawks usually nest in large native trees, such as valley oak, cottonwood, walnut and willow and occasionally in nonnative trees, such as eucalyptus. Nests occur in riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves and on the edges of remnant oak woodlands. Narrow bands of remnant riparian forest along drainages contain most of the known nests in the Central Valley (Estep, 1984; Schlorff and Bloom, 1984; England et al., 1997). This appears to be a function of the availability of nest trees instead of a dependence on riparian forest. Swainson's hawks are essentially plains or open-country hunters, requiring large areas of open landscape for foraging. With substantial conversion of grasslands to farming operations, they have shifted their nesting and foraging into those agricultural lands that provide low, open vegetation and high rodent prey populations such as alfalfa fields. Threats to Swainson's hawk include loss and fragmentation of foraging habitat, loss of nesting habitat, disturbance of nests and pesticide poisoning in wintering habitat (Anderson et al., 2007).

Potential for Occurrence in the Project Area. Swainson's hawks are known to occur in the project site. Suitable foraging and nesting habitat is present in and adjacent to the project area.

North Stockton

Six occurrences have been documented within the Delta Front/North Stockton project area. Two occurrences exist within the project footprint at Mosher Slough and Calaveras-Right. One occurrence exists at Calaveras-Right within 0 to 100 feet of the project area. Two occurrences exist within 101 and 500 feet from the project at Mosher Slough at Shima Tract and Calaveras-Right. Three occurrences exist within 501 feet to 0.5 miles at Shima Tract, Fourteenmile Slough Dry Land Levee and Calaveras-Right.

Central Stockton

Eight occurrences were documented. Three occurrences exist within the project footprint at SJR Mile, French Camp Slough and Duck Creek. One occurrence exists within 101 and 500 feet from the project area at Calaveras-Left. Four occurrences exist within 501 feet to 0.5 miles at Calaveras Left, SJR and Smith Canal.

RD 17 Area

Eight occurrences have been documented. Two occurrences are within the proposed project footprint along the SJR and additional 3 occurrences are documented for the west bank of the SJR immediately opposite the project area. The remaining 3 occurrences are east of the project area, within the interior of RD 17.

Tricolored Blackbird

Status. The tricolored blackbird (*Agelaius tricolor*) is a USFWS Bird of Conservation Concern and California State candidate species (December 2015). Tricolored blackbird is a medium-sized blackbird that is distinguished from other blackbirds by its distinctive white-tipped red shoulder patches on mature males. Females show varying amounts of red on the shoulders and their plumage is sooty brown and streaked overall.

Distribution and Habitat. The species is largely endemic to California, with smaller populations in Baja, Nevada Oregon and Washington. During the breeding season, tricolored blackbirds inhabit the Central Valley, the low foothills of the Sierra Nevada and Coast Range from Shasta County south to Kern County, the coast from Sonoma County south to the Mexican border (Beedy, 1991).

Tricolored blackbirds nest in small-to-large colonies (up to 50,000 individuals). They often return to the same nesting areas in subsequent years but will occasionally relocate their breeding colonies if suitable habitat is available elsewhere. The tricolored blackbird breeds in large colonies near fresh water, preferably in emergent wetland with tall, dense cattails or tules but also in thickets of willow, blackberry and wild rose. Nesting colonies of tricolored blackbird are highly susceptible to disturbance. Ideal breeding habitat includes two elements: (1) dense nesting substrate (i.e., blackberry or aquatic emergent vegetation) which provides protection from predators; and (2) a large supply of insects within proximity to nests and occurring at the time of fledging. Tricolored blackbirds forage in large flocks and may travel up to 4 miles (6.4 km) from nest or roost sites to forage. They forage on the ground in croplands, grassy fields, flooded land and along edges of ponds (Zeiner et al., 1990). In the Delta and Central Valley, foraging habitat consists primarily of pastures and certain types of agricultural fields.

Potential for Occurrence in the Project Area. The tricolored blackbird is unlikely to occur in the project site. Foraging habitat is present in small areas of freshwater marsh and riparian habitats. However, nesting is not expected because of low-quality habitat. The tricolored blackbird is not known to occur in the North or Central Stockton reaches of the study area.

RD 17 Area

Five occurrences have been documented within the project footprint. One occurrence exists south of Howard road, 0.5 mile east of the project area. Two occurrences exist 0.5 mile west of Interstate 5 and the SJR. Two additional occurrences exist at the southern end of the project area more than 1 mile away.

Yellow-Headed Blackbird

Status. The yellow headed blackbird (*Xanthocephalus xanthocephalus*) is a California State Species of Special Concern. The adult male is mainly black with a yellow head and breast with a white wing patch sometimes only visible in flight. The adult female is mainly brown with a dull yellow throat and breast.

Distribution and Habitat. Breeds commonly, but locally, east of Cascade Range and Sierra Nevada; in Imperial and Colorado River valleys; in the Central Valley; and at selected locations in the Coast Ranges west of the Central Valley. They nest in colonies, often sharing their habitat closely with the red-winged blackbird in fresh emergent wetland with dense vegetation and deep water, often along borders of lakes or ponds. The species forages in emergent wetland and moist, open areas, especially cropland and muddy shores of lacustrine habitat. Distribution is restricted to the Central Valley in winter, occurring mainly in the western portion. Occurs as a migrant and local breeder in deserts and along the coast of Orange County. It is known to have bred as high as 2000 m (6600 ft) in San Bernardino Mountains (Grinnell and Miller, 1944; McCaskie et al., 1979; Garrett and Dunn, 1981).

Potential for Occurrence in the Project Area. The yellow headed blackbird is unlikely to occur within the project area and there were no known occurrences in the North and Central Stockton reaches.

RD 17 Area

Three occurrences have been documented. One occurrence exists within 501 feet to 0.5 miles. Two occurrences exist within greater than 0.5 miles and less than 1 mile.

5.12.1.2 Special Status Plant Species

A total of 18 special-status plant species were evaluated for their potential to occur in the project areas. Six of these species were identified from documented CNDDB (2014) occurrences within USGS 7.5-minute quadrangle Waterloo [478C]), Lodi South [479D], Stockton East [461B], Stockton West [462A], Lathrop [462D], Manteca [461C]. A search of the USFWS endangered species database produced two special-status plant species (USFWS 2014). The 18 species consist of Alkali milk-vetch (*Astragalus tener*), Heartscale (*Atriplex cordulata* var.*cordulata*), San Joaquin spearscale (*Atriplex joaquinana*) Round leaved filaree (*California macrophylla*) Owl's clover (*Castilleja campestris ssp. succulent*) slough thistle (*Cirsium crassicaule),* Big tarplant (*Blepharizonia plumose*), watershield (*Brasenia schreberi*) Palmate-bracted bird's beak (*Chloropyron palmatum*), Delta button celery (*Eryngium racemosum*), rose mallow (*Hibiscus lasiocarpus*), Delta tule pea (*Lathyrus jepsonii var. jepsonii*), Mason's lilaeopsis (*Lilaeopsis masonii*), Delta mudwort (*Limosella subulata*), Sanford's arrowhead (*Sagittaria sanfordii*), Suisun marsh aster (*Symphyotrichum lentum*), Wright's trichocoronis (*Trichocoronis wrightii var. wrightii*) and Saline clover (*Trifolium hydrophilium).* Table 5-35 lists each special-status plant species along with its regulatory, Federal, State and CNPS listing, its habitat requirements and information related to each species' potential to occur overall project areas.

Potential for Occurrence in the Project Area. Four special-status plant species may occur within or adjacent to the project area. These 4 include Alkali milk-vetch, Slough thistle, Big tarplant and Rose mallow. The remaining 12 special-status plant species are unlikely to occur on or near the project site.

North Stockton

Three occurrences of Mason's lilaeopsis exist within the project footprint at Shima Tract, Fivemile Slough and Fourteenmile Slough. One documented occurrence of Rose mallow exists on site at Calaveras-Right and another occurrence exists 100 feet of the project site at Calaveras-Right.

Central Stockton

One occurrence of Rose mallow exist within the project footprint occurrence exists 100 feet of the project site at the SJR. One occurrence of Alkali milk vetch exists at Smith Canal/ within 101-500 feet; however, the record is possibly extirpated. Three occurrences of Tule pea exist within the Central Stockton project

area. These are along the SJR and at Smith Canal; however, the records indicate that the plants are possibly extirpated.

RD 17 Area

Three occurrence of slough thistle exist within the project footprint at the SJR.

5.12.1.3 Special Status Fish Species

Special-status fish species that occur or could occur in or near the study area, as well as their likely status in the study area, are presented in Table 5-35. Critical habitat for Central Valley steelhead, green sturgeon, and delta smelt falls within the study area in the SJR system.

Chinook Salmon

Chinook salmon are anadromous fish, meaning that adults live in marine environments and return to their natal freshwater streams to spawn. Juveniles rear in freshwater for a period of up to 1 year until smoltification (i.e., a physiological preparation for survival in marine environments) and subsequent ocean residence.

Two distinct runs of Chinook salmon occur in the SJR system: fall-run and late fall–run. The runs are named after the season of adult migration. Each run has a distinct combination of adult migration, spawning, juvenile residency and smolt migration periods. In general, fall- and late fall-run Chinook salmon spawn soon after entering their natal streams.

Central Valley Fall-/Late Fall-run Chinook salmon ESU (Oncorhynchus tshawytscha)

Status. On September 16, 1999 (64 FR 50393), NMFS determined that listing was not warranted for the Central Valley fall-/late fall-run Chinook salmon ESU; however, the ESU was designated as a candidate for listing because of concerns about specific risk factors. On April 14, 2004 (69 FR 19975) the Central Valley fall-/late fall-run Chinook salmon ESU was classified as a species of concern. The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and SJR Basins and their tributaries east of the Carquinez Strait. The Central Valley fall-/late fall-run Chinook salmon ESU is currently the largest run of Chinook salmon in the SJR system. Because they represent the greatest proportion of all four runs in the Central Valley, they continue to support commercial and recreational fisheries of significant economic importance.

Distribution and Habitat. Fall-run Chinook salmon adults would primarily pass through the study area on their way to spawn in tributaries of the SJR (Moyle, 2002). Juveniles migrate from SJR tributaries (e.g., Stanislaus, Merced and Tuolumne rivers) and other river tributaries, through the SJR during the late winter and spring (February through mid-June) (San Joaquin River Group Authority, 2009). Juvenile Chinook salmon utilize the edges of rivers and sloughs for rearing as they migrate downstream (Moyle, 2002).

The Central Valley fall-/late fall–run Chinook salmon ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and SJR basins and their tributaries. Central Valley fall-/late fall–run Chinook salmon are currently the most abundant and widespread salmon runs in California (Mills et al. 1997). The average escapement in-river on the Sacramento and San Joaquin system from 1960 to 2010 was 231,009 (CDFW, 2013).

Adult fall-run Chinook salmon migrate into the SJR 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 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 fall-run Chinook salmon migrate upstream before they are sexually mature and hold near 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 April through June. Juvenile late fall-run Chinook salmon rear in their natal streams during the summer and in some streams they remain throughout the year. Smolt outmigration can occur from November through May (Yoshiyama et al., 1998).

Potential for Occurrence in the Project Area. These fish occur in the Sacramento and SJR, tributaries and Delta. The species occurs seasonally in the SJR in the project vicinity.

Central Valley Steelhead DPS *(Oncorhynchus mykiss)*

Status. On March 19, 1998, NMFS listed the Central Valley steelhead DPS as threatened (63 FR 13347). Central Valley steelhead DPS are all considered to be winter-run steelhead (McEwan and Jackson, 1996). Similar to other anadromous salmonid species, these fish mature in the ocean before entering freshwater on their spawning migrations. The project site is located within designated critical habitat for the Central Valley DPS. The major factor influencing steelhead populations in the SJR system is the loss of habitat due to construction of impassable dams on major tributaries leading to favorable spawning areas.

Distribution and Habitat. Adult steelhead migrate upstream to spawning habitat during the winter and early spring. Females use riffles or pools with gravel substrate to spawn and then return to sea after resting in slower moving waters. Juvenile steelhead reside in nursery streams for one to three years before migrating to the ocean in the spring. Similar to Chinook salmon, juvenile steelhead would likely utilize the edges of rivers and sloughs for rearing as they migrate (Moyle, 2002).

Potential for Occurrence in the Project Area. The SJR near the project site would be used by adult and juvenile steelhead primarily as a migration corridor between the ocean and cold-water habitat in the upstream tributaries which would include the Calaveras River.

Green Sturgeon (Acipenser medirostris)

Status. On January 23, 2003, NMFS determined that green sturgeon (*Acipenser medirostris*) are comprised of two populations, a northern and a southern DPS (NMFS 2003). The northern DPS includes populations extending from the Eel River northward and the southern DPS includes populations south of the Eel River to the Sacramento River. The Sacramento River supports the southernmost spawning population of green sturgeon (Moyle 2002). On April 6, 2005, NMFS determined that the northern DPS does not warrant listing under the ESA, but it remains on the Species of Concern List (NMFS 2005c). On April 7, 2006, NMFS determined that the southern DPS of green sturgeon was threatened under the Federal ESA (NMFS 2006). On October 9, 2009, NMFS (74 CFR 52300) designated critical habitat for the green sturgeon southern DPS throughout most of its occupied range.

Green sturgeon were classified as a Class 1 Species of Special Concern by CDFW in 1995 (Moyle et al. 1995). Class 1 Species of Special Concern are those that conform to the State definitions of threatened or endangered and could qualify for addition to the official list. On March 20, 2006, emergency green sturgeon regulations were put into effect by CDFW requiring a year-round zero bag limit of green sturgeon in all areas (CDFG 2006).

Distribution and Habitat. The green sturgeon is anadromous but it is the most marine-oriented of the sturgeon species and has been found in near shore marine waters from Mexico to the Bering Sea (NMFS 2005c). The southern DPS has a single spawning population in the Sacramento River (NMFS 2005d) and

more recently spawning has been observed in the lower Feather River, a tributary of the Sacramento River (Seesholtz et al. 2012).

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 (NMFS 2005c). Little is known about the specific spawning habitat preferences of green sturgeon. Adult green sturgeon 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 degrees Fahrenheit (°F). 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 the lower Feather River (Seesholtz et al. 2012).

Green sturgeon eggs hatch in about 8 days at 55°F (Moyle 2002). Larvae begin feeding 10 days after hatching. Metamorphosis to the juvenile stage is complete within 45 days of hatching. Juveniles spend 1 to 4 years in fresh and estuarine waters and then migrate to salt water at lengths of 300 to 750 millimeters (mm) (NMFS 2005c). The juvenile habitat is poorly understood. Juvenile green sturgeon inhabit the Sacramento River and Delta. In the river, they occupy low-light habitats with some rock structure during their first winter. Juveniles have been reported to forage at night while seeking the darkest available habitats during the day (Kynard 2005 in Israel and Klimley 2008). Juvenile green sturgeon have morphological and behavioral attributes for holding in flowing riverine environments (Allen et al. 2006a in Israel and Klimley 2008). In the estuary, it is possible that older juvenile green sturgeon are capable of moving across highly variable physical gradients in salinity, temperature and dissolved oxygen as are adults in the ocean environment (Kelly et al. 2007, Moser and Lindley 2007 in Israel and Klimley 2008). Kaufman et al. (2006) found the oxygen binding of green sturgeon juveniles appeared to have low temperature sensitivity that would permit fishes to bind sufficient oxygen with increased water temperatures. The oxygen binding and uploading responses of juvenile green sturgeon across a range of temperatures between 11^0 and 24^0 C suggests they are capable of inhabiting slightly hypoxic-environments while maintaining moderate aerobic activity (Kaufman et al. 2006). These experimental data also suggest green sturgeon have a limited ability to handle increased environmental $C0_2$ Flow may indirectly influence juvenile foraging and survival by modifying the availability of freshwater and low-salinity habitats in the Delta and Suisun Bay during green sturgeon's first year of life (Israel and Klimley 2008).

Little is known about movements, habitat use and feeding habits of green sturgeon. Green sturgeon have been salvaged at the 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 (NMFS 2005c).

Potential for Occurrence in the Project Area. Information regarding green sturgeon distribution in the SJR was limited to anecdotal reports and CDFW sturgeon report card data. Information regarding sturgeon habitat use and movements throughout the SJR is lacking but critical to improve management and protection of these species. Angler fishing report cards document a small sturgeon fishery in the reach of the SJR upstream of Stockton, California (river kilometer, hereafter rkm, 64). Since implementation of the Sturgeon Report Card in 2007, anglers have reported catching 169 white sturgeon and 6 green sturgeon on the SJR upstream from Stockton (Gleason et al. 2008; DuBois et al. 2009, 2010, 2011 and 2012, as cited in Jackson, Z. J. and J. P. Van Eenennaam, 2013). Of the reported fish, 108 (64 percent) white and 5 (83 percent) green sturgeon were caught between Stockton and the Highway 140 bridge (rkm 202). The remaining 61 (36 percent) white and 1 (17 percent) green sturgeon were caught upstream of the Highway 140 bridge. Reports indicate anglers concentrate in two areas known locally as Sturgeon Bend (rkm 119) and Laird Park (rkm 143; H. Rutherford, CDFW warden, personal communication, as cited in Jackson, Z. J. and J. P. Van Eenennaam. 2013). Additionally, anglers and game wardens indicate that sturgeon caught during March

and April commonly expel milt or eggs during handling, indicating that spawning could be occurring nearby (Jackson, Z. J. and J. P. Van Eenennaam. 2013).

Delta Smelt

Status. Delta smelt (*Hypomesus transpacificus*) was Federally-listed as threatened on March 5, 1993 (USFWS 1993). Critical habitat was designated on December 19, 1994 (USFWS 1994). Population trends and abundance of Delta smelt are poorly understood due to their short life span (1 year). Based on data from 21 years of monthly sampling in Suisun Marsh, Delta smelt appear to be experiencing long-term declines (Matern et al. 2002). Summer tow-net and fall/mid-water trawl data show fluctuating annual abundance from 1991 through 1996, with an increasing trend in the late 1990s, followed by an overall decline in abundance since 1999 (Bryant and Souza 2004).

Distribution and Habitat. Delta smelt are endemic to the Sacramento-San Joaquin estuary and are found seasonally in Suisun Bay and Suisun Marsh. Historically, the upstream limits of their range were the upper limits of the Delta (Sacramento on the Sacramento River and Mossdale on the SJR). The lower limit is the western Suisun Bay (Radtke 1966; Moyle 1976, as cited in Moyle et al. 1992). Delta smelt are typically found in shallow water (less than 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. They have relatively low fecundity. Most live for 1 year and 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. Spawning occurs between January and July, with peak spawning from April through mid-May (Moyle 2002). Spawning locations in the Delta identified and are inferred from larval catches (Bennett 2005). Larval fish have been observed in: Montezuma Slough; Suisun Slough in Suisun Marsh; the Napa River estuary; the Sacramento River above Rio Vista; and Cache, Lindsey, Georgiana, Prospect, Beaver, Hog, Sycamore and Barker Sloughs (Wang 1986; Moyle 2002; Stillwater Sciences 2006; and USFWS 1996). Spawning was also observed in the Sacramento River up to Garcia Bend (RM 51) during drought conditions, as a result 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, demersal and usually attached to substrate composed of gravel, sand or other submerged material (Moyle 2002, Wang 1991). Hatching takes 9 to 13 days and larvae begin feeding 4 to 5 days later. Newly hatched larvae contain a large oil globule that makes them semi-buoyant and allows them to stay near the bottom. As their fins and swim bladder develop, they move higher into the water column and are transported downstream to the open waters of the estuary (Moyle 2002).

Potential for Occurrence in the Project Area. Delta smelt occur in tidally influenced segments of the Sacramento and SJRs, tributaries and Delta. Has potential to occur in the SJR in the project vicinity.

Longfin Smelt

Status. Longfin smelt are designated as a Federal species of concern and listed as a threatened species under California ESA.

Distribution and Habitat. Distribution of longfin smelt is centered in the West Delta, Suisun Bay and San Pablo Bay. In wet years, they are distributed more toward San Pablo Bay and in dry years more toward the west Delta. Peak spawning occurs between February and April in upper Suisun Bay and the lower and middle Delta. Spawning takes place at night, in sandy substrates near rocks and aquatic plants. After spawning, most smelt will die but some females have been known to survive another year. Spawning rarely occurs upstream of Medford Island in the SJR (Moyle et al., 1995).

Potential for Occurrence in the Project Area. The study area is upstream of Medford Island and longfin smelt eggs and larvae are not expected to occur near the project.

Sacramento Splittail

Status. On September 22, 2003, USFWS removed Sacramento splittail from the list of threatened species. At the time of delisting, the USFWS determined that threats to Sacramento splittail were being addressed through habitat restoration actions such as the CALFED Bay-Delta Program and the CVPIA. However, the delisting is currently being reviewed under court order. Sacramento splittail are endemic to California. Except for very wet years, they are mostly confined to the Delta, Suisun Bay, Suisun Marsh and Napa Marsh (USFWS, 1996).

Distribution and Habitat. Overall, the species distribution has been reduced to less than one-third of its original range. Splittail spawn in late April and May in Suisun Marsh and between early March and May in the upper Delta and lower reaches of the Sacramento and SJRs. Spawning in the tidal freshwater habitats of the Delta has been observed as early as January and as late as July (Sommer et al., 2002). Spawning occurs primarily in the lower reaches of rivers, flood bypasses and dead-end sloughs. Eggs adhere to benthic substrates and vegetation when laid (Wang, 1986). Splittail occur in the SJR upstream of its confluence at the Tuolumne River (Moyle, 2002) with adults and juveniles having been reported upstream of Modesto (USFWS, 1996). Juvenile emigration into the Delta begins in late winter (e.g., February) and continues throughout the summer. Juvenile splittails are most abundant in water less than 6 feet deep but show considerable capacity to swim against strong river and tidal currents (Moyle, 2002). As they migrate downstream to the Delta, they tend to favor areas with abundant vegetation (Wang, 1986).

Potential for Occurrence in the Project Area. Sacramento spilittail occurs in the Sacramento and SJRs, tributaries and Delta with potential to occur in the SJR in the project vicinity.

Hardhead (Mylopharodon conocephalus)

Status. Hardhead, a relatively large cyprinid species, is listed as a California Species of Special Concern; no Federal designation has been made.

Distribution and Habitat. Although this species is widespread and abundant throughout the Sacramento River and SJR systems, recent declines in numbers have raised concern. Hardhead are typically found in low- to mid-elevation streams and reservoirs. In streams, adult hardhead tend to utilize the deepest portions of the water column, rarely moving into the upper water column, while juveniles demonstrate a preference for shallow water close to the stream banks (Moyle et al., 1995). Hardheads prefer clear, deep, calm streams with temperatures in excess of 20 C. Spawning takes place in gravel or rocky substrate in runs, riffles and pools. Larval hardheads remain under vegetation near stream or lake margins and as they mature, they into deeper water.

Potential for Occurrence in the Project Area. Hardhead are unlikely to occur in the SJR near the Study Area.

San Joaquin Roach (Lavinia symmetricus)

Status. The San Joaquin roach is a state species of concern.

Distribution and Habitat. The roach is generally found in small warm streams at mid-elevations with dense populations being observed in isolated pools (Leidy, 2007), but are also present under diverse conditions in cooler large streams. Spawning is temperature dependent when water exceeds 16 C in March through July (Santos et al., 2014). Large groups will spawn over small rock substrates in riffles, between rock interstices (Santos et al., 2014). Due to late spring spawning, young juveniles avoid being flushed downstream to less favorable habitat due to less chance of high flow events (Santos et al., 2014).

Potential for Occurrence in the Project Area. Not likely to occur in the SJR in the project vicinity.

River Lamprey (Lampetra ayresi)

Status. On January 27, 2003, USFWS received a petition to Federally list river lamprey in Oregon, Washington, Idaho and California as threatened or endangered under the Endangered Species Act. In 2004, the USFWS found that the petition did not provide the required information to indicate that listing the species may be warranted and, therefore, a status review was not initiated.

Distribution and Habitat. River lampreys are found from just north of Juneau, Alaska, to the San Francisco Bay in California. However, detailed information on their distribution and abundance is lacking. River lampreys are associated with large river systems such as the Fraser, Columbia, Klamath, Eel and Sacramento Rivers. River lamprey appear to be concentrated only in particular rivers and only in the lower portions of these large rivers. Little is known on the life history of river lampreys in the Sacramento-SJR systems as no studies have been done on the California populations. They are an anadromous species, spending relatively short amounts of time, 3 to 4 months, in the ocean feeding on fish. Their prey of preference is salmon and herring, attaching above the lateral line and feeding on the muscle tissue. They are known to continue feeding on the organism even after it has died (Santos et al., 2014). Migration into fresh water is thought to take place in fall with spawning occurring in winter and spring in small tributaries. Adult lampreys create depressions in the gravel of riffle systems to deposit their eggs and die after spawning (Santos et al., 2014). Larval lampreys are known as ammocoetes and once hatched, move to silt sand back waters and bury themselves tail-first. It is assumed they spend 3-5 years in freshwater systems before metamorphosing into adults. Metamorphosis occurs over a 9 to 10 month period and afterwards they aggregate in large numbers; moving to the ocean late in the spring (Santos et al., 2014).

Potential for Occurrence in the Project Area. This species occurs in tributaries of the Sacramento and SJRs. Not likely to occur in the SJR in the project vicinity.

Factors that Affect Abundance of Fish Species

Information relating abundance with environmental conditions is mostly available for listed fish species, especially Chinook salmon. The following section focuses on factors that have potentially affected the abundance of listed species in the Central Valley. Although not all species are discussed, anthropogenic factors that negatively affect the listed species are assumed to also affect the abundance of other native and nonnative species in similar fashion for native fishes or could provide more suitable water quality conditions and habitat features to better support nonnative fishes.

Spawning Habitat Area. Spawning habitat area could limit the production of juveniles and subsequent adult abundance of some species. Spawning habitat area for fall- and late fall–run cChinookhinook salmon, which compose more than 90 percent of the Chinook salmon returning to the Central Valley streams, has been identified as limiting their population abundance. Existing spawning habitat area has not been identified as

a limiting factor for the less-abundant winter-run and spring-run Chinook salmon (NMFS, 2005a, USFWS, 1996) although habitat could be limiting in some streams (e.g., Butte Creek) during years of high adult abundance.

Delta smelt spawn in fresh water at low tide on aquatic, submerged, and inshore plants and over sandy and hard bottom substrates of sloughs and shallow edges of channels in the upper Delta and Sacramento River above Rio Vista (Wang 1986, Moyle, 2002). Spawning habitat area has not been identified as a factor affecting delta smelt abundance (USFWS, 1996), but little is known about specific spawning areas and requirements in the Delta.

Rearing Habitat Area. Rearing habitat area could limit the production of juveniles and subsequent adult abundance of some species. WS (1996) has indicated rearing habitat area in Central Valley streams and rivers limits the abundance of juvenile fall-run and late fall–run Chinook salmon and juvenile steelhead. Rearing habitat for salmonids is defined by environmental conditions such as water temperature, dissolved oxygen (DO), turbidity, substrate, water velocity, water depth, and cover (Jackson, 1992; Bjornn and Reiser, 1991; Healey, 1991). Chinook salmon also rear along the shallow vegetated edges of Delta channels (Grimaldo et al., 2000).

Environmental conditions and interactions among individuals, predators, competitors and food sources determine habitat quantity and quality and the productivity of the stream (Bjornn and Reiser, 1991). Everest and Chapman (1972) found juvenile Chinook salmon and steelhead of the same size using similar in-channel rearing area.

Rearing area varies with flow. High flow increases the area available to juvenile Chinook salmon, because they extensively use submerged terrestrial vegetation on the channel edge and the floodplain. Deeper inundation provides more overhead cover and protection from avian and terrestrial predators than shallow water (Everest and Chapman in Jackson, 1992). In broad, low-gradient rivers, change in flow can greatly increase or decrease the lateral area available to juvenile Chinook salmon, particularly in riffles and shallow glides (Jackson, 1992).

Rearing habitat for larval and early juvenile Delta smelt encompasses the lower reaches of the Sacramento River below Isleton and the SJR below Mossdale. Estuarine rearing by juveniles and adults occurs in the lower Delta and Suisun Bay. USFWS (1996) has indicated that loss of rearing habitat area would adversely affect the abundance of larval and juvenile Delta smelt. The area and quality of estuarine rearing habitat are assumed to be dependent on the downstream location of 2 ppt salinity (Moyle et al., 1992). The condition where 2 ppt salinity is located in the Delta is assumed to provide less habitat area and lower quality than the habitat provided by 2 ppt salinity located farther downstream in Suisun Bay. This geographic distribution would not always be a function of outflow and 2 ppt isohaline position. Outflow and the position of the 2 ppt isohaline may account for only about 25 percent of the annual variation in abundance indices for delta smelt (DWR and USBR, 1994).

Rearing habitat has not been identified as a limiting factor in splittail population abundance but as with spawning, a lack of sufficient seasonally flooded vegetation may be limiting population abundance and distribution (Young and Cech, 1996). Rearing habitat for splittail encompasses the Delta, Suisun Bay, Suisun Marsh, the lower Napa River, the lower Petaluma River and other parts of San Francisco Bay (Moyle, 2002). In Suisun Marsh, splittail concentrate in the dead-end sloughs that have small streams feeding into them (Daniels and Moyle, 1983; Moyle, 2002). As splittail grow, salinity tolerance increases (Young and Cech, 1996). Splittail are able to tolerate salinity concentrations as high as 29 ppt and as low as 0 ppt (Moyle, 2002).

Migration Habitat Conditions. The SJR and the Delta provide a migration pathway between freshwater and ocean habitats for adult and juvenile steelhead and all runs of Chinook salmon. Suitable habitat conditions during steelhead and Chinook salmon spawning runs include streamflows that provide suitable water velocities and depths that provide successful passage. Flow in the San Joaquin River and in Delta provides the necessary depth, velocity and water temperature; however, flow and environmental conditions in the Central Valley are not always at optimal levels (water temperature). In the Delta, the channel pathways affect migration of juvenile Chinook salmon. Juvenile Chinook salmon survival is lower for fish migrating through the central Delta (i.e., diverted into the Delta Cross Channel and Georgiana Slough) than for fish continuing down the Sacramento River (Newman and Rice, 1997). Similarly, juvenile Chinook salmon entering the Delta from the SJR appear to have higher survival rates if they remain in the SJR channel instead of moving into Old River and the south Delta (Brandes and McLain, 2001).

Larval and early juvenile delta smelt are transported by currents that flow downstream into the upper end of the mixing zone of the estuary where incoming saltwater mixes with outflowing fresh water (Moyle et al., 1992). Reduced flow could adversely affect transport of larvae and juveniles to rearing habitat.

Adult splittail gradually move upstream during the winter and spring to spawn. Year-class success of splittail is positively correlated with wet years, high Delta outflow and floodplain inundation (Sommer et al., 1997; Moyle, 2002). Low flow impedes access to floodplain areas that support rearing and spawning.

Water Temperature. Fish species have different responses to water temperature conditions depending on their physiological adaptations. Salmonids in general have evolved under conditions in which water temperatures need to be relatively cool. Delta smelt and splittail can tolerate warmer temperatures. In addition to species-specific thresholds, different life stages have different water temperature requirements. Eggs and larval fish are the most sensitive to warm water temperature.

Unsuitable water temperatures for adult salmonids such as Chinook salmon and steelhead during upstream migration lead to delayed migration and the potential for lower reproduction rates. Elevated summer water temperatures in holding areas cause mortality of spring-run Chinook salmon (USFWS, 1996). Warm water temperature and low DO also increase egg and fry mortality. USFWS (1996) cited elevated water temperatures as limiting factors for fall- and late fall-run Chinook salmon.

Juvenile salmonid survival, growth and vulnerability to disease are affected by water temperature. In addition, water temperature affects prey species abundance and predator occurrence and activity. Juvenile salmonids alter their behavior depending on water temperature, including movement to take advantage of local water temperature refugia (e.g., movement into stratified pools, shaded habitat, subsurface flow) and improve feeding efficiency (e.g., movement into riffles). Water temperature in Central Valley rivers frequently exceeds the tolerance of Chinook salmon and steelhead life stages. For example, adult fall-run Chinook salmon have been observed to stop their upstream migration when water temperatures exceed 66°F (Hallock et al., 1970). For Chinook salmon eggs and larvae, survival during incubation is assumed to decline with increasing temperature between 54°F and 61°F (Myrick and Cech, 2001; Seymour 1956 in Alderice and Velsen, 1978). For juvenile Chinook salmon, survival is assumed to decline as temperature warms from 64°F to 75°F (Myrick and Cech, 2001; Rich, 1987). Relative to rearing, Chinook salmon require cooler temperatures to complete the parr-smolt transformation and maximize their saltwater survival. Successful smolt transformation is assumed to deteriorate at temperatures ranging from 63°F to 73°F (Marine 1997 in Myrick and Cech, 2001; Baker et al., 1995).

For steelhead, successful adult migration and holding are assumed to deteriorate as water temperature warms between 52°F and 70°F. Adult steelhead seem to be more sensitive to thermal extremes than are juveniles (NMFS, 1996; McCullough, 1999). Conditions supporting steelhead spawning and incubation are assumed to deteriorate as temperature warms between 52°F and 59°F (Myrick and Cech, 2001). Juvenile rearing success is assumed to deteriorate at water temperatures ranging from 63°F to 77°F (Raleigh et al., 1984; Myrick and Cech, 2001). Relative to rearing, smolt transformation requires cooler temperatures and successful transformation occurs at temperatures ranging from 43°F to 50°F. Juvenile steelhead, however, have been captured at Chipps Island in June and July at water temperatures exceeding 68°F (Nobriga and Cadrett, 2001). Juvenile Chinook salmon have also been observed to migrate at water temperatures warmer than expected based on laboratory experimental results (Baker, 1995).

Delta smelt and splittail populations are adapted to water temperature conditions in the Delta. Delta smelt could spawn at temperatures as high as 72°F (USFWS, 1996) and could rear and migrate at temperatures as warm as 82°F (Swanson and Cech, 1995; Young and Cech, 1996).

Entrainment. All fish species are entrained to varying degrees by the SWP and CVP Delta export facilities and many other smaller diversions in the Delta and Central Valley rivers. Fish entrainment and subsequent mortality are highly variable among species and could be a function of the size of the diversion, the location of the diversion, the behavior of the fish (Swanson et al., 2004, 2005) and other factors such as fish screens, the presence of predatory species and water temperature. Diversions that divert relatively little water from the total channel and with low approach velocities are assumed to minimize stress and protect fish from entrainment.

Diversions and Delta inflow and outflow may affect survival of Delta smelt. In water exported at the South Delta CVP and SWP export facilities, estimates of Delta smelt entrainment suggest a population decline in the early 1980s, mirroring the decline indicated by mid-water trawl, summer tow-net, Kodiak trawl and beach seine data (Bennett 2005). Diversions and upstream storage, including operation of the CVP and SWP, control Delta inflow and outflow during most months. Reduced Delta flow may inhibit or slow movement of larvae and juveniles to estuarine rearing habitat and into deeper and narrower channels of the Delta, resulting in lower prey availability and increased mortality from predators (Moyle 2002). Low Delta flow may also increase entrainment in diversions, including entrainment at the CVP and SWP export pumps (Moyle 2002). Additional factors affecting Delta smelt abundance include extremely high river outflow that increases entrainment at export facilities, changes in prey abundance and composition, predation by nonnative species, toxic substances, disease and loss of genetic integrity through interbreeding with the introduced Wagasaki smelt (Moyle 2002; CDFG 2000; Bennett 2005). Juvenile Chinook salmon are entrained in all months, but primarily from November through June when juveniles are migrating downstream.

Although several studies documenting entrainment at small, unscreened Delta diversions are available, few address population-level effects or accurately estimate the total loss of fish at the diversions studied (Moyle and Israel, 2005). Some diversions could in fact entrain large numbers of individuals. However, many studies report capturing mostly larval or post-larval fish, with the majority of the catch being dominated by nonnative species such as gobies, threadfin shad and striped bass (Cook and Buffaloe, 1998; Nobriga et al., 2004).

Contaminants. In the Sacramento and SJR basins, industrial and municipal discharge and agricultural runoff transport contaminants into rivers and streams that ultimately flow into the Delta. Principal pollutants in the Delta are agricultural chemicals and their derivatives (Herbold et al., 1992). Organophosphate insecticides, such as carbofuran, chlorpyrifos and diazinon are present throughout the Central Valley and dispersed in agricultural and urban runoff. The "first-flush" storm event or the "dormant spray" storm event is of most concern because of the higher concentration of contaminants in the runoff. In particular, diazinon and chlorpyrifos are applied to control wood-boring insects in dormant stone fruit orchards from December to February (Zamora et al., 2003).

These contaminants enter rivers in winter runoff and enter the estuary in concentrations that could be toxic to invertebrates (CALFED Bay-Delta Program, 2000). Unlike severe bioaccumulators such as organochlorine pesticides, organophosphate pesticides are typically metabolized by most invertebrates. Some organophosphate pesticides do not bioaccumulate, while some do. In particular, diazinon has a solubility of 68.9 milligrams per liter (mg/L) at 68°F but should not bioaccumulate in aquatic organisms (Zamora et al., 2003). Chlorpyrifos is more persistent in the environment and tends to be hydrophobic to the water column. Chlorpyrifos has a lower solubility than diazinon (1.12 mg/L at 75°F) and a significant potential to bioaccumulate in aquatic organisms (Zamora et al., 2003). Because some organophosphate could accumulate in living organisms, they could become toxic to fish species, especially those life stages that remain in the system year-round and spend considerable time there during the early stages of development, such as Chinook salmon, steelhead, splittail, green sturgeon and Delta smelt.

Mercury contamination from historical mining activities is extensive on both sides of the Central Valley and occurs primarily from widely scattered hydraulic mining debris along eastside tributaries and abandoned mines and associated debris piles on the west side. These sources continue to deposit significant amounts of mercury into the Bay-Delta system. The Cosumnes River, Yolo Bypass and Sacramento River are the primary ongoing sources of mercury contamination in the Bay-Delta. Mercury occurs in several forms, including pure elemental mercury and toxic methylmercury. Mercury is mobile in aquatic systems as aqueous mercury or when attached to suspended particulate matter. Methylmercury is a significant water quality concern because small amounts can bioaccumulate in fish to levels that are toxic to humans and wildlife. In the Delta, mercury concentrations in bluegill, Sacramento sucker and largemouth bass have been found to exceed the human health standard of 0.5 part per million (ppm) by two to six times (Slotten et al., 2003).

Other contaminants of particular concern in the Bay-Delta system include high concentrations of trace elements such as selenium, copper, cadmium and chromium; however, their effects on higher trophic levels are poorly understood, in part as a result of the complex distribution of high concentrations in both time and space (Herbold et al., 1992). In general, it appears that the highest concentrations occur in areas where human activity adjacent to the bay is also the highest. Although these trace elements also occur naturally, concentrations of these trace elements have been found to be high enough to adversely affect the growth and reproduction of aquatic animals in laboratory experiments (Herbold et al., 1992).

Predation. Nonnative species cause substantial predation mortality on native species. Studies at Clifton Court Forebay estimated predator-related mortality of hatchery-reared fall-run Chinook salmon to be from about 60 percent to more than 95 percent. Although the predation contribution to mortality is uncertain, the estimated mortality suggests that striped bass and other predatory fish, primarily nonnative, pose a threat to juvenile Chinook salmon moving downstream, especially where the stream channel has been altered from natural conditions. Turbulence from water passing over dams and other structures could disorient juvenile Chinook salmon and steelhead, increasing their vulnerability to predators. Predators such as striped bass, largemouth bass and catfish also prey on Delta smelt and splittail (USFWS, 1996).

Food. Food availability and type affect survival of fish species. Species such as threadfin shad and wakasagi could affect Delta smelt survival through competition for food. Introduction of nonnative food organisms could also affect Delta smelt and other species' survival. Nonnative zooplankton species are more difficult for small smelt and striped bass to capture, increasing the likelihood of larval starvation (Moyle, 2002). Splittail feed on opossum shrimp, which in turn feed on native copepods that have shown reduced abundance, potentially attributable to the introduction of nonnative zooplankton and the Asiatic clam (*Potamorcorbula amurensis)*. In addition, the timing and quantity of flow releases made at upstream dams that is not associated with any of the proposed alternatives affects the abundance of food in rivers, the Delta and Suisun Bay. In general, the timing of flows that simulate natural flow regimes result in higher productivity including a higher input of nutrients from channel margins and floodplain inundation and higher production when low salinity occurs in the shallows of Suisun Bay. Higher productivity also increases the availability of prey organisms for Delta smelt and other fish species.

5.12.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Consultation History

NMFS

USACE informally consulted with the USFWS and NMFS during the development of the LSJRFS. Meetings and phone calls with USACE and NFMS took place to discuss the LSJRFS and the potential species affected within the study area. USACE also formally consulted with NMFS, under Section 7, and received a biological opinion with an incidental take statement for listed fish and designated critical habitat. The biological opinion included EFH recommendations.

During PED phase, coordination with the resource agencies would continue in order to ensure that the LSJRFS remains in compliance with the completed Section 7 consultation. USACE would coordinate potential design refinements with USFWS and NMFS to avoid, minimize and off-set any adverse effects on listed species. Formal Section 7 consultation would be reinitiated with USFWS and NMFS if changes to the LSJRFS occurred that were noncompliant with this BO. The following list summarizes the consultation history to date:

- 2013 – Initial species list obtained for the study area of the LSJRFS.
- May 29-30, 2013 – USFWS, DWR and USACE environmental staff participated in a field tour of the LSJRFS area.
- 2014 – Updated species list obtained.
- On June 24, 2014, the USFWS submitted a Draft FWCA Report to USACE.
- July 22, 2014 – USACE, USFWS and NMFS met to discuss the study status, the LSJRFS alternatives, draft impact assessment and approaches to mitigation and conservation measures.
- February 5, 2015 – An updated species list for San Joaquin County and pertinent quads were obtained from the USFWS website.
- March 2, 2015 – USACE transmitted the draft Biological Assessment (BA) to NMFS and requested comments prior to initiating informal section 7 consultation with NMFS under the ESA.
- March 31, 2015 – NMFS sent correspondence to USACE requesting additional information from USACE to support the consultation.
- April 2, 2015 – USACE and NMFS met to discuss NMFS' letter advising USACE of additional information needed to support the consultation.
- July 30, 2015 – USACE and NMFS biologists had a phone conversation to discuss potential conservation measures for the LSJRFS. Discussion centered on potential areas where conservation measures would be most effective.
- September 17, 2015 – Meeting between USACE and NMFS to discuss the LSJRFS and conservation measures for the LSJRFS.
- November 9, 2015 – NMFS receives the final BA for the LSJRFS and a request for formal section 7 consultation under the ESA from USACE for effects to threatened California Central Valley (CCV) steelhead (Oncorhynchus mykiss) distinct population segment (DPS) and the threatened southern DPS (sDPS) of the North American green sturgeon (Acipenser medirostris), their designated critical habitats and EFH described for Pacific Salmon (Oncorhynchus spp.) in Amendment 18 of the Pacific Coast Salmon Fishery Management Plan (USACE 2015).
- December 10, 2015 – NMFS responds to USACE that sufficient information has been made available to initiate formal consultation under section 7 of the ESA for the LSJRFS. However, NMFS stated in its letter that it will also include effects to individuals of the threatened Central Valley (CV) spring-run Chinook salmon (O. tshawytscha) evolutionary significant unit (ESU) in light of the reintroduction of this run of fish into the waters of the SJR basin. NMFS indicated that USACE should expect that a BO will be furnished to USACE on or before March 23, 2016.

USFWS

- February 27, 2015 – USACE transmits letter and BA requesting formal consultation.
- June 8, 2015 – USFWS transmits letter requesting additional information.
- November 6, 2015 – USACE transmits revised BA.
- December 9, 2015 – Following review of the BA, USFWS staff request Tables E1, E2 and E3, discussed in the BA and verification that USACE is consulting on effects of the project construction, ETL compliance and operation and maintenance.
- December 10, 2015 – USACE transmits email with attachment "Table E: Pre-project vegetation and vegetation lost from project implementation." USACE confirms by follow up telephone call that it is consulting on ETL compliance and operation and maintenance, to the extent known, as well as project construction.
- January 7, 2016 – USFWS staff (Steve Schoenberg) attends site visit to project area with USACE (Tanis Toland, Ryan Larson), SJAFCA (Eric Ambrizz) and consultant engineer. The descriptions of future maintenance in the project description are based on discussions at this site visit.
- January 21, 2016 – USACE transmits email with an attached shapefile of the project footprint with areas, work types and other information.
- January 22, 2016 – USACE staff (Tanis Toland) inform USFWS via telephone call of project changes, namely, the Dad's Point floodwall maybe a berm and the setback mitigation area will be modified (i.e., extended south, still within reach FM_30_L).
- March 18, 2016 – USFWS transmits draft BO by email attachment to USACE.
- March 30, 2016 – USACE transmits consolidated team comments on draft BO.
- April 18, 2016 – USFWS transmits second draft BO by email attachment to USACE.
- April 22, 2016 – USACE transmits consolidated team comments on second draft BO.

During the preconstruction engineering and design phase of the project, if authorized, USACE would then do a site-specific analysis including full biological site surveys and site-specific engineering. USACE shall prepare supplements to either draft or final EISs if: (1) USACE makes substantial changes in the proposed action that are relevant to environmental concerns; or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. If necessary, USACE would re-initiate consultation with USFWS and NMFS to address changes.

5.12.2.1 Special Status Wildlife Species

Assessment Methods

This section evaluates the effects of the proposed alternatives on special status wildlife species in the project area. Initial evaluation determined that several species potentially occur or that suitable habitat exists. Special-status species are defined as animals that are legally protected under the Federal ESA, California ESA or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing. Based on the USFWS (2014) species list and CNDDB (CDFG, 2014) records search for the quadrangles overlapping the affected area, 15 special-status plant and wildlife species were identified as potentially occurring (known to or may occur) in the affected area (Table 5-35).

Borrow Sites

Specific borrow locations have not been identified for the proposed project, but it is assumed that sufficient suitable materials would be available within a 25-mile radius from the project.

Special status species and suitable habitat for these species that are known to occur in or near the project area are identified in Table 5-35, "Special Status Species and Critical Habitats." A literature review and database search indicates that Federally-listed threatened or endangered species may be present within 25 miles of the project action area. The CNDDB records and literature search indicates that State listed, threatened, endangered, rare or species of special concern may also be present within 25 miles. Potential borrow sites would be situated and appropriate conservation measures implemented, to avoid effecting Federal- and State-listed species.

Basis of Significance

Adverse effects on special status species were considered significant if implementation of an alternative would:

- Result in direct or indirect reduction in growth, survival or reproductive success of species listed or proposed for listing as threatened or endangered under the Federal ESA or California ESA.
- Result in direct mortality, long-term habitat loss or lowered reproductive success of Federal- or State-listed threatened or endangered animal or plant species or candidates for Federal listing.
- Result in direct or indirect reduction in the growth, survival or reproductive success of substantial populations of Federal species of concern, State-listed endangered or threatened species, plant species listed by the CNPS or species of special concern or regionally important commercial or game species.
- Have an adverse effect on a species' designated critical habitat.

5.12.2.2 Special Status Fish Species

Assessment Methods

To prepare for the analysis of the potential effects on fish species, a review of existing resource information related to the project area to evaluate whether sensitive habitats and special-status fish species are known from or could occur in the study area was conducted. The information reviewed included the following sources: an USFWS list of endangered, threatened and proposed species for the Lodi South, Waterloo, Stockton East and West, Manteca and Lathrop USGS 7.5-minute quadrangles (USFWS, 2014); Google Earth Pro™; and, published and unpublished documents and reports pertaining to the study area.

Basis of Significance

Populations of fish and other aquatic organisms may be reduced because of increased mortality and changes in habitat availability and suitability that affect survival, growth, migration and reproduction. In general, effects on fish populations are significant when the project causes or contributes to substantial short or long term reductions in abundance and distribution. The assessment of potential effects takes into consideration the significance of an action based on its context and its intensity, as required by NEPA. Based on Section 15065 and Appendix G of the State CEQA Guidelines, an effect is found to be significant if it:

- Has 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 the CDFW or USFWS;
- Interferes 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 reduces the habitat of a fish population;
- Causes a fish population to drop below self-sustaining levels;
- Threatens to eliminate an animal community;
- Reduces the number or restricts the range of a rare or endangered fish species; or
- Has considerable cumulative effects when viewed with past, current and reasonably foreseeable future projects.

5.12.3 ALTERNATIVE 1 - NO ACTION

5.12.3.1 Special Status Wildlife Species

Under the No Action Alternative, there would be no Federal action identified. Flood events may cause possible levee failure due to seepage, slope instability, erosion and overtopping. Activity involved with flood fighting, levee protection and repair have the potential to cause harm to special status species and their critical habitats. Heavy equipment would be needed to move emergency supplies and personnel to locations along the levee system requiring emergency stabilization and repair. Flood risk is expected to continue as long as the through- and under-seepage issues remain unresolved. Adverse effects to listed species could include future loss or damage of individual species and/or their terrestrial and critical habitats. Potential losses of habitat and individual listed species could occur.

5.12.3.2 Special Status Fish Species

Under the No Action Alternative, risk to floodplain development would increase due to pressures presented by climate change. If flood events were to occur, there is a risk of possible levee failure due to seepage, slope stability, erosion, and overtopping. The chance of overtopping events increases with the challenges faced by sea level rise. Activity involved with flood fighting, levee protection and repair has the potential to cause harm to the fish populations found in the San Joaquin River system. Heavy equipment would be needed to move emergency supplies and personnel to locations along the levee system requiring emergency stabilization and repair. Heavy equipment has the potential to destroy riparian habitat used by organisms that are potential sources of food. The chemicals, oil and fuel commonly used in this equipment has the potential to leak into the environment and into the riverine system, causing injury or death to fish populations.

It is common to use large rocks and sand bags to shore up the levee system during flood events. This action has the potential to reduce habitat used by juvenile fish for protection from predators as they move downstream. In addition, the placement of and future removal of these items will potentially result in an

increase in sediment introduction and turbidity which would have a negative effect on fish migration, spawning locations and success, as well as rearing habitats. Noise from all activities could cause migration patterns to change to avoidance activity, disrupting successful spawning events. Given the unpredictable nature of emergency activities, it is unlikely BMPs could be implemented to reduce negative effects to fish populations.

In the event of the levee being compromised by overtopping, seepage or loss of bank stability, there are additional risks associated with fish populations. Straying could occur, causing a portion of distinct genetic population segments of fish to be unable to reach historical spawning grounds. When flood waters recede, fish strandings are likely to take place by adults as well as juvenile fish, reducing these populations. Levee failure would allow for the introduction of pollutants into the system. Flooding in developed urban areas would introduce a number of household chemicals, oils, fuels, pharmaceuticals organic and inorganic pollutants. These substances have multiple ways of affecting fish populations, increasing risk for mortality. Agricultural land also presents the hazard for chemical and organic materials from entering the riverine system in the event of a levee breach. The use of herbicides, pesticides and fertilizers on the soil is well known. All these chemicals have numerous ways in which they will interact in an aquatic environment, having negative impact to fish populations. Potential losses of habitat and individual listed species could occur. Depending on the size of the catastrophic event, losses to listed species and critical habitat would be **significant**.

5.12.4 ALTERNATIVE 7A

5.12.4.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle (VELB)

Direct effects to VELB may occur if elderberry shrubs are incidentally damaged by construction personnel or equipment. Impacts may also occur if elderberry shrubs need to be transplanted because they are located in areas that cannot be avoided by construction activities. Potential impacts due to damage or transplantation include direct mortality of beetles and/or disruption of their lifecycle.

Subsequent to releasing the Draft FR/EIS/EIR, a protocol-level field survey was completed within the Alternative 7a project area. Refer to Table 5-36 for quantities by area. This survey identified 44 elderberry shrubs (28 nonriparian and 16 riparian) within the Alternative 7a project area. The surveys were conducted in accordance with the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999). All elderberry shrubs with the potential to be affected by project activities were mapped and surveyed to determine the size of the stems on each shrub, location of shrubs to riparian habitat and presence of exit holes. Compensation for effects to these shrubs and the beetle are in Section 5.12.10.1. Compensation would be based upon the USFWS guidelines, which require transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for the elderberry longhorn beetle. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less than significant**. However, project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

Table 5-36: Study Area Potential Elderberry Shrubs

Alternative Area	Project Area			Totals
Alternative 7a	**North**	**Central**	**RD 17**	
Riparian	8	8	0	16
Non-Riparian	0	28	0	28
		Alternative 7a Total Shrubs		**44**
Alternative 7b	**North**	**Central**	**RD 17**	
Riparian	8	6	14	28
Non-Riparian	17	14	31	62
		Alternative 7b Total Shrubs		**90**
Alternative 8a	**North**	**Central**	**RD 17**	
Riparian	11	14	0	25
Non-Riparian	23	31	0	54
		Alternative 8a Total Shrubs		**79**
Alternative 8b	**North**	**Central**	**RD 17**	
Riparian	11	14	14	39
Non-Riparian	23	31	31	85
		Alternative 8b Total Shrubs		**124**
Alternative 9a	**North**	**Central**	**RD 17**	
Riparian	8	11	0	19
Non-Riparian	17	23	0	40
		Alternative 9a Total Shrubs		**59**
Alternative 9b	**North**	**Central**	**RD 17**	
Riparian	11	11	14	36
Non-Riparian	23	23	31	77
Alternative 9b Total Shrubs				**113**

Giant Garter Snake (GGS)

Several areas within the Alternative 7a study area may potentially affect GGS or their habitat. Construction would occur between May 1 and October 1, during the snake's active season to minimize impacts to the species. Compensation for effects to GGS habitat is in Section 5.12.10.1. Construction would occur above the OHW line. USFWS has recommended the avoidance and minimization measures for GGS based on BMPs shown to reduce impacts to the snake.

Additional effects to GGS could occur during the installation of the closure structure measures at Smith Canal. Installation of the control structure would require coffer dams to provide a temporarily dry work space. The coffer dams and construction equipment would temporarily create noise and could prevent river connectivity for GGS movement. With the implementation of the avoidance and minimization measures described in Section 5.12.10.1, impacts to GGS could be reduced to less than significant. The potential loss of upland habitat would be mitigated by purchasing acreage from a USFWS approved mitigation bank. The implementation of the avoidance and minimization measures would help to reduce or avoid effects on GGS and its habitat that occur within 200 feet of any construction activity. The measures are based on USFWS guidelines for restoration and standard avoidance measures.

Additional effects to GGS could occur during the installation of the closure structure measures at Fourteenmile Slough. The effects would be similar to those regarding the Smith Canal structure. With the implementation of the avoidance and minimization measures described in Section 5.12.10.1, temporary one-season impacts to GGS would be reduced to **less than significant**. Despite avoidance, minimization and compensation measures, construction and O&M activities are likely to adversely affect GGS due to permanent impacts to 12.5 acres of GGS upland habitat and 0.5 acre of aquatic habitat, as well as potential take during construction activities in aquatic and upland GGS habitat.

Swainson's Hawks

It is estimated that 139 acres of riparian habitat used by Swainson's hawk for roosting and nesting could be affected and 363 acres of ruderal habitat could be removed or disturbed as a result of construction activities at levees. Much of this habitat is within the Stockton urban/agricultural interface, where Swainson's hawks nest and forage along the SJR and Calaveras River. Additional habitat for Swainson's hawks exists within and adjacent to the Sacramento Bypass. This area is less urbanized and hawks may be more sensitive to human activities. Prior to the onset of construction, biological surveys for the presence of nesting raptors (white-tailed kites, Swainson's hawks and Cooper's hawks) would be conducted within 0.5 mile of the proposed construction area. If a survey determines that a nesting pair is present, USACE would coordinate with CDFW and USFWS. To avoid potential effects to nesting raptors, CDFW typically requires the avoidance of nesting sites during construction activities and/or avoiding construction during the nesting season. If construction activities are determined to be necessary during the nesting season, then an on-site biologist/monitor experienced with raptor behavior would be available to monitor the nest while construction-related activities are taking place. If raptors exhibit agitated behavior in response to construction-related activities, the biological monitor would have the authority to stop work and would consult with CDFW and USFWS to determine the best course of action necessary to avoid nest abandonment or takeof individuals. The proposed conservation measures would reduce the effects on white-tailed kites, Swainson's hawks and Cooper's hawks to **less than significant**.

Short-term Effects to Special Status Bird Species

Noise, vibration, visual and proximity-related disturbances associated with construction measures could adversely affect special status birds if they are nesting on or adjacent to the study area during construction. Bird species that could occur within the study area include burrowing owl, White-tailed kite, Song sparrow, Least Bell's vireo and migratory bird species. Since construction would occur between August 1 and October 31, outside of the spring nesting season, it is unlikely that nesting birds would be present. However, if individuals of these species nest during the construction period, construction disturbances could cause them to abandon their nests or young. The breeding success of these species could be reduced if disturbances reduce the ability of adults to properly care for their young. The Alternative 7a construction footprint covers a large area that contains substantial nesting habitat; therefore, potential adverse effects to nesting birds are possible and are considered **significant**. To reduce this impact to **less than significant**, mitigation measures would be implemented (See Section 5.12.10.1).

Burrowing owls could potentially exist within areas disturbed by construction activities such as levees and borrow material sites. Construction activities, including grading and excavation activities at the source material sites, could result in nesting failure, death of nestlings or loss of eggs. Effects on burrowing owls could be significant if they are present at these sites. Prior to initiation of any excavation activities at the source material sites, a preconstruction survey for burrowing owls would be completed in accordance with CDFW guidelines described in the Staff Report on Burrowing Owl Mitigation (CDFG, 2012). If no burrowing owls are located during these surveys, then effects to burrowing owls would be less than significant and no mitigation would be required. If burrowing owls are located on or immediately adjacent

to the site, then coordination would occur with CDFW to determine the proper measures to be implemented to ensure that burrowing owls are not impacted by the project. Potential avoidance and minimization measures that could be implemented are in Section 5.12.10.1, which would reduce impacts to this species to a **less than significant** level.

Short Term Effects to Special Status Bat Species

Construction activities have the potential to result in direct impacts to western red bat and the pallid bat. Though construction activities are restricted to a localized area, tree removal or trimming could occur at the project and source material sites resulting in direct disturbance or mortality to western red bat maternity roosts. Indirect impacts to western bat maternity roosts could also occur from noise and vibration caused by construction activity nearby. Impacts to the western red bat would be considered significant; however, implementation of the mitigation measures described in Section 5.12.10.1, would reduce impacts to this species to a **less than significant** level.

5.12.4.2 Special Status Plant Species

Construction measures have the potential to disturb plant species that have been documented in the local area. Blooming-period surveys of the project area were not conducted for special-status plant species with potential to occur; surveys would occur before construction. Species that may be potentially affected are Alkali milk vetch, Big tarplant, Delta tule pea, Mason's lilaeopsis, Rose mallow and Slough thistle. The potential for loss of individual plants is likely due to the excavation of material at the levee and material source sites.

The sponsor would retain qualified botanists to and document the presence of special status plants before project implementation. The botanists will conduct a floristic survey that follows the CDFW botanical survey guidelines. If special status plant populations are detected where construction would create unavoidable impacts, the sponsor would prepare and implement a compensatory mitigation plan in coordination with USFWS or CDFW. Such plans may include salvage, propagation, on site reintroduction in restored habitats and monitoring. Implementation of these protective measures should prevent any significant adverse impact to these special status plant species.

Loss of CNPS-listed plant species would be regulated by CDFW if the loss is substantial and could affect the long term survival of the affected population. Because the presence and extent of any special-status plants in the project construction area are unknown, this effect would be considered significant.

Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. Habitat would be protected in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.4.3 Special Status Fish Species

North Stockton

Alternative 7a would include the construction of levee remediation measures to address: under and through seepage; restoration to USACE levee design criteria; erosion; geometry; removal of vegetation; seismic stability; and FRM identified for Mosher Slough, Shima Tract, Fivemile Slough, Fourteenmile Slough and Tenmile Slough.

The following significant adverse effects to native and nonnative fish species could occur:

All levee fixes proposed would follow USACE's policies regarding vegetation on levees, which forbid all woody vegetation on the crown, slopes and within 15 feet of the waterside and landside levee toes. These zones would be maintained free of woody vegetation in perpetuity. However, subsequent to release of the Draft FR/EIS/EIR, additional investigation and coordination with the NMFS's lead senior fisheries biologist responsible for the project area, resulted in the conclusion that the full suite of characteristics that comprise SRA are not present in Mosher, Fivemile, Fourteenmile and Tenmile sloughs and no SRA is actually present in these areas.

The proposed levee fixes would require ground-disturbing activities that potentially cause erosion and soil disturbance, subsequently resulting in sediment transport and delivery to aquatic habitats. Increases in sedimentation and turbidity have been shown to affect fish physiology, behavior and habitat. An increase in sedimentation and turbidity could occur in adjacent water bodies during earth-moving activities.

High concentrations of suspended sediment can have direct and indirect effects on fish. In general, larger fish tend to be more tolerant than smaller fish, while eggs and fry are the least tolerant. For salmonids, elevated turbidity levels have been observed to elicit several behavioral and physiological responses: gill flaring, coughing, avoidance and increase in blood sugar levels. These responses indicate some levels of stress. Stress responses are generally higher with increasing turbidity and decreasing particle size. Turbidity could reach levels associated with avoidance behavior and reduced feeding success. Migrating adult salmonids have been reported to avoid high silt loads or cease migration when such loads are unavoidable (Cordon and Kelley 1961 in Bjornn and Reiser, 1991).

Short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in a temporary displacement of fish from preferred habitats. High concentrations of fine sediments reduce or eliminate much of the suitable substrate necessary for macroinvertebrate production, limiting the food available to juvenile salmonids (Meehan, 1991) and other species. Consequently, growth rates of fish could be reduced if suspended sediment and turbidity levels substantially exceed ambient levels for prolonged periods. Substantial sediment input could adversely affect the migration of migratory species.

Disturbance of soil adjacent to the shoreline along levee toes and faces would temporarily increase turbidity above natural backgrounds in the immediate vicinity of these activities, potentially affecting fish species. It is expected that turbidity resulting from construction and maintenance activities would be intense in the vicinity of the activity, but would rapidly attenuate with time and space.

The potential for adverse effects on fish from an increase in turbidity and sedimentation in adjacent waters is low for the following reasons:

- Environmental commitments, including an erosion and sediment control plan would be developed and implemented before and during construction activities and would minimize the potential for increasing sedimentation and turbidity.
- Any increases in turbidity and sedimentation as a result of program activities would be temporary and limited to small portions of the overall water body.
- In-water construction would be limited to the typical construction season and during periods of low fish abundance and outside the principal spawning and migration season. Typical construction season generally corresponds to the dry season, but project area construction could occur outside the limits of the dry season, only as allowed by applicable permit conditions.
- Migratory and resident fish would likely move upstream, downstream or laterally to an unaffected portion of the river in response to in-channel work and would therefore be unaffected by any increases in turbidity or sedimentation should they occur.
- If present, migratory species, such as adult and juvenile salmonids, would be expected to bypass channel reaches with elevated turbidity and sediment levels because a sufficient portion of the channel's width (i.e., zone of passage) would remain unaffected.

Construction-related short term effects on fish would include effects related to noise, vibrations, artificial light and other physical disturbances caused by heavy equipment operation. These types of physical disturbances can disrupt or delay normal activities or cause injury or mortality. The potential magnitude of effects depends on a number of factors, including the type and intensity of the disturbance, proximity of the action to the water body, timing of actions relative to the occurrence of sensitive life stages and frequency and duration of activities.

For most activities, if present, noise-related effects on fish would be limited to avoidance behavior in response to movements, noises and shadows caused by construction personnel and equipment operating in or adjacent to the water body.

However, construction-related noise levels are not expected to cause delay or adversely affect upstream or downstream migration of salmon, steelhead and other migratory species for the reasons listed below:

- Construction would be limited to the typical construction season and during periods of low abundance and outside the principal spawning and migration season. Typical construction season generally corresponds to the dry season, but construction may occur outside the limits of the dry season, only as allowed by applicable permit conditions.
- Migratory and resident native and nonnative fish species would likely move upstream, downstream or laterally to an unaffected portion of the river in response to noise or disturbance and would therefore be unaffected.
- If present, migratory species, such as adult and juvenile salmonids, would be expected to bypass channel reaches with noises or disturbances because a sufficient portion of the channel's width (i.e., zone of passage) would remain unaffected.

Noise, vibrations, and other physical disturbances can harass fish, disrupt or delay normal activities, and cause injury or mortality. In fish, the hearing structures and swim bladder and surrounding tissues are particularly vulnerable to high-pressure sounds (Popper, 2006). The type and severity of effects depends on several factors, including the intensity and characteristics of the sound, the distance of the fish from the source, the timing of actions relative to the occurrence of sensitive life stages and the frequency and duration

of the noise-generating activities. The range of effects potentially includes behavioral effects, physiological stress, physical injury (including hearing loss) and mortality.

Given the proposed construction activities for the Fourteenmile Slough closure structure, the effects of noise on fish would be limited primarily to avoidance behavior in response to movements, vibrations and noise caused by construction personnel and equipment operating in or adjacent to the slough. However, underwater pile-driving noise could reach levels that would be capable of fish injury or mortality. Potential exposure of adult and juvenile salmonids to pile-driving sounds would be minimized by conducting all in-water pile-driving activities during 1 construction season between July 1 and September 30, when the lowest numbers of Chinook salmon and steelhead are likely to be present in the area.

There is no formal agreement on the thresholds to be used to evaluate the potential for adverse behavioral effects from underwater pile-driving noise. NMFS and USFWS generally use 150 decibel (dB) root mean square as the threshold for behavioral effects for listed salmonids. Although no scientific support for this criterion is available, it is considered a general threshold for identifying potential behavioral responses (e.g., avoidance or alarm) that could disrupt normal activity patterns or decrease the ability of fish to avoid predators.

Juvenile fish, including green sturgeon that may be residing in the detection range of pile-driving sounds (1,100 yards), could respond in ways (e.g., leaving protective cover) that increase their vulnerability to predators.

The following measures are part of the proposed project and are intended to reduce potential adverse effects on native and nonnative fish species and their habitat.

- All in water construction activities would be limited to the period of June 1 through October 31 to avoid the primary migration periods of listed salmonids.
- In water pile driving would be restricted to the period of July 1 through September 30 to avoid or minimize exposure of adults and juvenile salmonids to underwater pile-driving sounds.
- All pile driving would be conducted by a vibratory pile driver to minimize underwater sound levels during pile-driving operations.
- Pile driving would be conducted by barge to minimize disturbance of riparian habitat.
- Conduct underwater noise monitoring during in water construction to validate noise thresholds established by agreement with CDFG, USFWS and NMFS with USACE are not exceeded.

Overwater and in water structures can alter underwater light conditions and provide potentially favorable holding conditions for adult fish, including species that prey on juvenile fishes. Permanent shading from installation of piles and other structures in the Fourteenmile Slough after the closure structure construction could increase the number of predatory fish (e.g., striped bass, largemouth bass) holding in the study area and their ability to prey on juvenile salmonids and other native and nonnative fish species.

When the closure structure on Fourteenmile Slough needs to be operated, native fish species would not have the option of passing upstream or downstream of the structure. This would not be considered a significant direct effect due to the large amount of available habitat that would still exist above and below the closure structure that can be utilized until non-operational conditions resume. Construction of this structure has the potential to disturb benthic communities from disturbance of sediment. This could disrupt food sources for certain species.

Following BMPs for construction activities described above, this would result in **less than significant** effects on special status aquatic species. However, direct and indirect effects would be **significant and unavoidable** due to the permanent closure structure on Fourteenmile Slough which could have indirect effects on native fish populations due to an increase of predatory species attracted to structure and shade

for hiding, increasing the predation on native fish species and the potential for entrainment during gate closure. While the impacts from proposed actions will be avoided and minimized where possible, it has been determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

Central Stockton

Construction effects would be the same as those described for the Delta Front/North Stockton Reach, except for the operation of the closure structure on Smith Canal and the removal of SRA habitat.

The Central Stockton reach would also be required to establish compliance with USACE ETL vegetation requirements, as explained in detail in Section 4.6 A total of 19,630 lf of SRA habitat located on the Calaveras River, SJR, French Camp Slough and Duck Creek would be removed. The permanent loss of the woody vegetation would result in a substantial adverse effect on riparian habitat and SRA.

Because of the numerous ways that riparian vegetation influences the stream ecosystem, the effects of altering riparian vegetation are highly variable, ranging from increased sedimentation and warmer localized stream temperature to decreased food production and habitat complexity. Removal of riparian vegetation would expose soils to erosive forces such as wind and rain and could reduce overhead and instream cover (e.g., SRA cover). The removal of riparian vegetation, large woody debris and aquatic vegetation directly affects the quantity and quality of cover for fish and aquatic invertebrates.

The loss of riparian vegetation that provides SRA cover for fish as a result of vegetation removal and maintenance activities would result in greater fragmentation of existing SRA cover. Although some of the existing SRA cover currently is fragmented. Further loss or fragmentation of SRA cover in the study area contributes to the increasing and cumulative degradation of the sensitive natural community in the Delta Front/North Stockton reach.

Because of the unique value and relative scarcity of this cover type in the Sacramento and SJR systems and because SRA cover is an essential component of fish habitat, removal of SRA cover would result in a significant effect on special-status fish such as juvenile Chinook salmon, steelhead, green sturgeon, Delta smelt and Sacramento splittail.

The various actions would result in the construction-related loss of riparian habitat. As discussed above, Riparian vegetation that supports SRA cover directly influences the quality of fish habitat, affecting cover, food, in-stream habitat complexity, stream bank stability and temperature regulation. Large woody debris usually originates from riparian trees and provides habitat complexity in aquatic environments, an essential component of fish habitat.

The existing overhead shade cover within the study area varies by location and along each waterway. The amount of SRA within the study area was calculated using aerial photography and determining which areas have overhanging vegetation and trees adjacent to the natural channel and which areas do not. Generally, greater shade cover occurs during summer when full tree canopies are present. Analysis of total lf (lf) of SRA was conducted using Google Earth Pro™ for the various reaches associated with ETL compliance in the study area.

Construction effects for the Smith Canal closure structure would be the same as those described for the Fourteenmile Slough closure structure. The purpose of the closure structure would be to cut off high water levels during high flow events. Operation of the closure structure would limit the water saturation levels in Smith Canal, which would reduce the risk of levee damage during flood events. Closure structure gates would be raised (closed) during high water levels on the SJR, typically during a flood event. Due to the

tidal influence of the Delta region, there is the potential that these high water events could last from a few days to a few months, depending on river conditions.

The Central Stockton reach would be required to establish compliance with the Vegetation ETL. Due to SRA habitat located on the Calaveras River, SJR, Duck Creek and French Camp Slough, there would be significant direct effects by reducing the available areas for shade and possible food sources available to special status fish species present in the study area. Implementation of mitigation, including receipt of a vegetation variance, would reduce direct and indirect effects from loss of SRA habitat; however, impacts to SRA, including potential entrainment during gate closure, would remain **significant and unavoidable** as discussed in detail in Sections 5.9 and 5.10. While the impacts from proposed actions will be avoided and minimized where possible, it was determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. Compensation measures are proposed for habitat impacts that could not be addressed through avoidance, minimization and conservation measures. USACE will seek opportunities during PED for onsite planting of waterside vegetation, if a variance is received, in accordance with the terms and conditions of the NMFS BO.

5.12.5 ALTERNATIVE 7B

Alternative 7b direct and indirect effects would be the same as described in Alternative 7a. Avoidance and minimization measures that could be implemented for construction activities (other than removal of SRA habitat) would reduce impacts to the **less than significant** level discussed in Section 5.12.10. Compensatory mitigation to offset the effects due to loss of SRA habitat would reduce impacts; however, impacts would remain **significant and unavoidable**, as discussed in Sections 5.9 and 5.10. While the impacts from proposed actions will be avoided and minimized where possible, it was determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.5.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Approximately 90 shrubs may potentially exist within the Alternative 7b study area. Refer to Table 5-36 for potential quantities by area. Compensation for effects to these shrubs and the beetle are in Section 5.12.10.1. Compensation would be based upon the USFWS guidelines which require transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for the VELB. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less than significant**. However, project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

Giant Garter Snake

No occurrences of GGS have been recorded in the RD 17 project area.

Brush Rabbit

A riparian brush rabbit preserve exists immediately adjacent to the Alternative 7b study area, specifically in RD 17 at the oxbow along the SJR. The oxbow has dense riparian vegetation on the waterside west of the proposed new levee site. Most of the waterside riparian vegetation represents potentially suitable habitat, while most of the landside vegetation is not suitable habitat because of its sparseness and

composition. The site is monitored and maintained by the Center for Natural Lands Management. Construction activities could result in harm to the brush rabbit and its habitat at the oxbow site. Brush rabbits could have their movement to and from the oxbow site potentially cut off by new levee construction activities. Rabbits could run onto the construction site, causing harm or death of individuals. The Sacramento USFWS wildlife office would be consulted for proper survey and monitoring technique and avoidance measures. The implementation of the avoidance and minimization measures described in Section 5.12.10.1, would help to reduce the effects to **less than significant**.

5.12.5.2 Special Status Plant Species

Impacts to special status plant species would be the same as described for Alternative 7a. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.5.3 Special Status Fish Species

Alternative 7b direct and indirect effects due to construction for the Delta Front/North Stockton and Central Stockton reaches would be the same as Alternative 7a, but would include levee remediation measures for RD 17. Following BMPs for construction activities described in 7a, other than removal of SRA habitat, would result in a less than significant effect for special status aquatic species. Implementation of mitigation measures would reduce direct and indirect effects from loss of SRA habitat, but impacts would remain **significant and unavoidable** as discussed in detail in Sections 5.9 and 5.10.

RD 17

Construction effects for the RD 17 reach would be the same as those described for the Delta Front/North Stockton Reach. The RD 17 reach would be required to establish compliance with USACE Vegetation ETL requirements through either a variance or VFZ. Due to SRA habitat located on the SJR and French Camp Slough, there would be significant direct effects by reducing the available areas for shade and possible food sources available to the existing special status fish species present in the study area. Implementation of mitigation measures would reduce direct and indirect effects from loss of SRA habitat, but impacts would remain **significant and unavoidable** as discussed in Sections 5.9 and 5.10. While the impacts from proposed actions will be avoided and minimized where possible, it was determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.6 ALTERNATIVE 8A

Alternative 8a direct and indirect effects from construction would be the same as those described for Alternative 7a, yet would include improvements along the Stockton Diverting Canal and construction of a new levee on the east side of the north bank of French Camp Slough. This alternative would not include improvements along the SJR in RD 17. Following BMPs for construction activities described in 7a, other than removal of SRA habitat, would result in a less than significant effect for special status aquatic species. Implementation of mitigation measures would reduce direct and indirect effects from loss of SRA habitat; however impacts would remain **significant and unavoidable** as discussed in Sections 5.9 and 5.10. While the impacts from proposed actions will be avoided and minimized where possible, it has been determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead

and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.6.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Alternative 8a would affect an estimated 79 elderberry shrubs (34 more than Alternative 7a). Compensation for effects to these shrubs and the beetle are in Section 5.12.10. Compensation would be based upon USFWS guidelines, which require transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for the VELB. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less than significant**, but project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the footprint or an off-site conservation area.

Giant Garter Snake

Alternative 8a would have additional direct and indirect effects on GGS from the proposed Stockton Diverting Canal improvements. Within the Central Stockton area, one existing CNDDB occurrence of GGS is recorded at the Stockton Diverting Channel. The channel has upland and aquatic habitat for the GGS. The habitat area within the Stockton Diverting Channel would be disturbed by construction for a single construction season. So, the effects from construction to GGS upland habitat would be temporary. The aquatic habitat within the channel would not be disturbed during construction. No permanent loss of GGS habitat would result from construction of the project measures. Once construction is completed, the area would be returned to the pre-construction conditions and provide similar upland habitat conditions. With the implementation of the avoidance and minimization measures described in Section 5.12.10 impacts to GGS would be reduced to **less than significant**. Despite avoidance, minimization and compensation measures, construction and O&M activities are likely to adversely affect GGS due to the potential take during construction activities in aquatic and upland GGS habitat.

5.12.6.2 Special Status Plant Species

Impacts to special status plant species would be the same as described for Alternative 7a. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.6.3 Special Status Fish Species

The Alternative 8a direct and indirect effects due to construction for the Delta Front/North Stockton and Central Stockton reaches would be the same as those described for Alternative 7a except for an extension of levee remediation on the Calaveras River and levee remediation on the Stockton Diverting Canal. Following BMPs for construction activities described in 7a, other than removal of SRA habitat, would result in a **less than significant** effect for special status aquatic species. Implementation of mitigation measures would reduce direct and indirect effects from loss of SRA habitat; however, impacts would remain **significant and unavoidable** as discussed in Sections 5.9 and 5.10). While the impacts from proposed actions will be avoided and minimized where possible, it has been determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We

have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.7 ALTERNATIVE 8B

Alternative 8b direct and indirect effects from construction would be the same as Alternative 7b, yet would include improvements along the Stockton Diverting Canal and construction of a new levee on the east side of the north bank of French Camp Slough. This alternative would include improvements along the SJR in RD 17.

5.12.7.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Alternative 8b would affect an estimated 124 elderberry shrubs (34 more than Alternative 7b). Compensation for effects to these shrubs and the beetle are in Section 5.12.10. Compensation would be based upon the USFWS guidelines, which requires transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for VELB. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less-than-significant**, but project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

5.12.7.2 Special Status Plant Species

Impacts to special status plant species would be the same as Alternative 7a. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.7.3 Special Status Fish Species

The Alternative 8b direct and indirect effects due to construction for the Delta Front/North Stockton and Central Stockton reaches would be the same as Alternative 7b, except the additional improvements along the Stockton Diverting Canal and construction of a new levee on the east side of the north bank of French Camp Slough. Following BMPs for construction activities described in 7b, other than removal of SRA habitat, would result in a **less than significant** effect for special status aquatic species. Implementation of mitigation measures would reduce direct and indirect effects from loss of SRA habitat; however, impacts would remain **significant and unavoidable** as discussed in Sections 5.9 and 5.10. While the impacts from proposed actions will be avoided and minimized where possible, it was determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.8 ALTERNATIVE 9A

Alternative 9a direct and indirect effects from construction would be the same as Alternative 7a, yet would include improvements along the Mormon Channel Bypass. This alternative would not include improvements along the SJR in RD 17. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10) and other relevant regulatory requirements. The project would protect habitat in place where possible.

5.12.8.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Alternative 9a would affect an estimated 59 elderberry shrubs (14 more than Alternatives 7a). Compensation for effects to these shrubs and the beetle are in Section 5.12.10.1 Compensation would be based upon the USFWS guidelines, which requires transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for VELB. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less than significant**, but project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

Construction of this feature has the potential to create short term habitat loss for VELB that could be present during construction. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.1) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on VELB would be reduced to a **less than significant level**. However, project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

5.12.8.2 Special Status Plant Species

Alternative 9a direct and indirect effects due to construction for the Delta Front/North Stockton and Central Stockton reaches would be the same as those described for Alternative 7a. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.8.3 Special Status Fish Species

Alternative 9a direct and indirect effects due to construction for the Delta Front/North Stockton and Central Stockton reaches would be the same as Alternative 7a. In addition, construction of the Mormon Channel Control Structure and Bypass Channel would be proposed for this alternative.

This measure consists of construction of a control structure and channel improvements to allow for up to 1,200 cfs of flood flows to be diverted down this channel. The Mormon Channel control structure includes a tainter gate that would be operated to divert water into the Mormon Channel during high water events. The gates would likely be operated every two years or so. The amount of water and duration of diverted flows would be adjusted according to the total flows moving through the system.

A flood control bypass system like this would likely only provide a corridor for migrating adult and juvenile fish, with no habitat for spawning or protection from predators. The 1,200 cfs could potentially be enough for attraction flow for fish migration up the Mormon Channel. Fish passage facilities located at the Stockton Diverting Canal should be considered in future planning. Due to the possibility of special status fish species in the Mormon Channel after a storm event, ramping down flows in the Mormon Channel so fish can escape to the main stem SJR before getting isolated in pockets and pools once flows are no longer being released into the Mormon Channel would be implemented. Following BMPs for construction activities described, other than removal of SRA habitat, would result in **less than significant** effects on special status aquatic species. However, short- and long-term removal of SRA habitat associated with construction activities

would result in a **significant and unavoidable effect**. While the impacts from proposed actions will be avoided and minimized where possible, it has been determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. Appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures is proposed.

5.12.9 ALTERNATIVE 9B

Alternative 9b direct and indirect effects from construction would be the same as Alternative 7b, yet would also include improvements along the Mormon Channel Bypass and improvements along the SJR in RD 17. The potential effects from the Mormon Channel Bypass are the same as those for Alternative 9a.

5.12.9.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Alternative 9b would affect an estimated 113 elderberry shrubs (24 more than Alternatives 7b). The direct and indirect effects due to construction for the Delta Front/North Stockton, Central Stockton and RD 17 reaches would be the same as described in Alternative 7b except for an extension of levee remediation on the Calaveras River and levee remediation on the Stockton Diverting Canal. Compensation for effects to these shrubs and the beetle are in Section 5.12.10. Compensation would be based upon USFWS guidelines which require transplanting existing shrubs when possible and new plantings of elderberry shrubs and associative plantings to provide and maintain habitat for VELB. With the implementation of the avoidance, minimization and compensation measures, impacts to VELB would be **less than significant**. However, project actions are likely to adversely affect valley elderberry longhorn beetles due to potential take during construction, primarily as a result of transplanting elderberry shrubs from the construction footprint to an area outside the project footprint or an off-site conservation area.

5.12.9.2 Special Status Plant Species

The effects of Alternative 9b from construction and operation for the Delta Front/North Stockton, Central Stockton and RD 17 reaches would be the same as those for Alternative 7b. Avoidance, minimization and compensation measures would be implemented in accordance with the requirements of the Federal ESA, California ESA (Section 5.12.10.2) and other relevant regulatory requirements. The project would protect habitat in place where possible. Therefore, potential adverse effects on special-status species and on sensitive habitats would be reduced to a **less than significant** level.

5.12.9.3 Special Status Fish Species

The effects of Alternative 9b from construction and operation for the Delta Front/North Stockton, Central Stockton and RD 17 reaches would be the same as those for Alternative 7b. Following BMPs for construction activities, other than removal of SRA habitat, would result in a **less than significant** effect on special status aquatic species. However, short- and long-term removal of SRA habitat associated with construction activities could result in a **significant and unavoidable** effect. While the impacts from proposed actions will be avoided and minimized where possible, it has been determined that the project actions may affect and are likely to adversely affect Delta smelt, Central Valley steelhead and sDPS green sturgeon. We have proposed appropriate compensation for habitat impacts that could not be addressed through avoidance, minimization and conservation measures.

5.12.10 CONSERVATION AND MITIGATION MEASURES

Conservation measures are similar for Alternatives 7a, 7b, 8a, 8b, 9a and 9b though the footprint is different for each alternative. Compensation for the loss of habitat supporting special status wildlife is based on the largest potential footprint and worst case scenario under each alternative. If design refinements are made at a later time that result in reduced impacts, compensation for the permanent loss of habitat will be coordinated with the appropriate resource agencies and adjusted accordingly.

5.12.10.1 Special Status Wildlife Species

Valley Elderberry Longhorn Beetle

Avoidance and Minimization Measures – Construction Phase

The following is a summary of measures based on the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS, 1999a). These measures would be implemented to minimize any potential effects on VELB or their habitat, including restoration and maintenance activities, long term, protection and compensation if shrubs cannot be avoided.

- When a 100-foot (or wider) buffer is established and maintained around elderberry shrubs, complete avoidance (i.e., no adverse effects) would be assumed.
- Where encroachment on the 100-foot buffer has been approved by USFWS, a setback of 20 feet from the dripline of each elderberry shrub would be maintained whenever possible.
- Shrubs that are closer than 100 feet to any work, but outside the construction footprint (construction, ETL compliance, OMRRR) are assumed to be avoided by the application of other avoidance measures such as signage, fencing, worker education and will not be subject to transplantation or the need for offset compensation.
- During construction activities, all areas to be avoided would be fenced and flagged.
- Contractors and work crews would be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Signs would be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.
- Any damage done to the buffer area would be restored.
- Buffer areas would continue to be protected after construction from adverse effects of the project, such as during maintenance actions.
- No insecticides, herbicides, fertilizers or other chemicals that might harm the beetle or its host plant would be used in the buffer areas.
- Trimming of elderberry plants may be subject to mitigation measures.
- Elderberry shrubs that cannot be avoided would be transplanted to an appropriate riparian area at least 100 feet from construction activities or to an approved conservation bank.
- If possible, elderberry shrubs would be transplanted during their dormant season (about November, after they have lost their leaves, through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation ratios would apply.
- Any areas that receive transplanted elderberry shrubs and elderberry cuttings would be protected in perpetuity.
- USACE would develop off-site compensation areas prior to or concurrent with any take of VELB.
- USACE will submit its site suitability study to USFWS for review and comment prior to implementation; and request and receive written concurrence from USFWS that the site(s) is suitable for compensation for this project prior to construction.
- Management of these lands would include all measures specified in USFWS's conservation guidelines (1999a) related to weed and litter control, fencing and the placement of signs.
- Monitoring would occur for ten consecutive years or for seven non-consecutive years over a 15-year period. Annual monitoring reports would be submitted to USFWS.
- Off site areas would be protected in perpetuity and have a funding source for maintenance.

Compensation Measures – Construction Phase

In accordance with the USFWS 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*, adverse effects to the VELB would be compensated by transplanting the affected elderberries with stems greater than 1 inch in diameter and by planting a mix of native riparian/or upland vegetation at a 2:1 and 6:1 ratio depending on the diameter size of the stems. The amount of compensation for VELB was based on preliminary surveys conducted since the Draft EIS/EIR was released for review. VELB compensation is proposed to occur in the 14 acre mitigation site that has been identified at the setback levee on Fourteenmile slough. This site would be planted with transplanted shrubs and new seedlings and associated riparian habitat, in accordance with the USFWS guidelines.

Avoidance and Minimization Measures – O&M Phase

- When a 100-foot (or wider) buffer is established and maintained around elderberry shrubs, complete avoidance (i.e., no adverse effects) will be assumed.
- Where encroachment on the 100-foot buffer has been approved by the USFWS, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- During maintenance activities, all areas to be avoided will be fenced and flagged.
- Maintenance personnel will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Dust control measures shall be implemented when O&M activities take place within 100 feet of elderberry shrubs.

Compensation Measures – Operation and Maintenance Phase

If elderberry shrubs require trimming during O&M activities, the non-Federal maintaining agencies would plant 1 seedling elderberry and 2 native plants for every 10 existing elderberry shrubs trimmed during O&M. A USFWS approved off site area would be identified to receive the compensation plantings.

Giant Garter Snake

Avoidance and Minimization Measures – Construction Phase

The following measures would be implemented to minimize effects on GGS habitat that occurs within 200 feet of any construction activity. These measures are based on USFWS guidelines for restoration and standard avoidance measures included as appendices in USFWS (1997).

- Unless approved otherwise by USFWS, construction would be initiated only during the GGS active period (May 1–October 1, when they are able to move away from disturbance).
- All construction personnel, including workers and contractors, will participate in a worker environmental awareness training program conducted by a USFWS-approved biologist prior to commencement of construction activities.
- A GGS survey would be conducted 24 hours prior to construction in potential habitat. Should there be any interruption in work for greater than two weeks, a biologist would survey the project area again no later than 24 hours prior to the restart of work.
- GGS encountered during construction activities would be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site would be restricted to established roadways. Stockpiling of construction materials would be restricted to designated staging areas, which would be located more than 200 feet away from GGS aquatic habitat.
- GGS habitat within 200 feet of construction activities would be designated as an environmentally sensitive area and delineated with signs and high visibility fencing. Fencing will be inspected and maintained as needed daily until completion of each work section of the project. This area would be avoided by all construction personnel.
- If USACE elects to use exclusionary fencing in lieu of continuous monitoring, it will be buried at least six inches below the ground to prevent snakes from burrowing and moving under the fence and will be inspected daily.
- If a frac-out is identified, all work will stop, including the recycling of the bentonite fluid. In the event of a frac-out into w6ater, the location and extent of the frac-out will be determined and the frac-out will be monitored for 4 hours to determine whether the fluid congeals (bentonite will usually harden, effectively sealing the frac-out location).
- USFWS, NMFS, CDFW and the Regional Water Quality Control Board will be notified immediately of any spills and will be consulted regarding clean-up procedures. A Brady barrel will be onsite and used if a frac-out occurs. Containment materials, such as straw bales, also will be onsite prior to and during all operations and a vacuum truck will be on retainer and available to be operational onsite within notice of 2 hours. The site supervisor will take any necessary follow-up response actions in coordination with agency representatives. The site supervisor will coordinate the mobilization of equipment stored at staging areas (e.g., vacuum trucks) as needed.
- If the frac-out has reached the surface, any material contaminated with bentonite will be removed by hand to a depth of 1-foot, contained and properly disposed of, as required by law. The drilling contractor will be responsible for ensuring that the bentonite is either properly disposed of at an approved Class II disposal facility or properly recycled in an approved manner.
- Project-related vehicles will observe a 20-mile-per-hour speed limit within construction areas, except on existing paved roads where they will adhere to the posted speed limits.

- Aquatic habitat for the snake that would be affected by construction will be inspected for the snake, then dewatered and maintained dry and absent of aquatic prey for 5 days before initiation of construction activities. This measure applies primarily to the ditches to be relocated west of the Delta front levee sections. If complete dewatering is not possible, USFWS will be contacted to determine what if any additional measures may be necessary to minimize effects to the snake.

Compensation Measures – Construction Phase

Compensation to off-set unavoidable effects on 12.5 acres of GGS upland habitat would be provided at a ratio of 1:1 through the purchase of credits at a mitigation bank. Compensation for permanent impacts to 0.5 acres of aquatic GGS habitat will be replaced at a 3:1 ratio through the purchase of credits at a mitigation bank.

If any GGS habitat is impacted by construction, the following measures would be implemented to compensate for the habitat loss:

- Habitat (including aquatic and upland) temporarily impacted for one season (May 1–October 1) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants.
- Aquatic habitat permanently impacted will be replaced at a 3:1 ratio.
- Upland habitat permanently impacted will be replaced at a 1:1 ratio.
- Habitat permanently or temporarily impacted outside of the May 1-October 1 work window will be created at a 2:1 ratio.
- USACE will work to develop appropriate mitigation prior to or concurrent with any disturbance of GGS habitat. Habitat will be protected in perpetuity.

The following measures would be implemented during construction of the proposed Fourteenmile Slough and Smith Canal closure structures to reduce potential adverse effects on GGS and their habitats.

- Unless approved otherwise by USFWS, construction would be initiated only during the GGS' active period (May 1–October 1, when they are able to move away from disturbance).
- Install and maintain exclusion and construction barrier fencing around suitable GGS habitat.
- Prepare and implement a Stormwater Pollution Prevention Plan.
- Prepare and implement a Spill Prevention, Control and Counter-Measure Plan.
- Conduct preconstruction surveys and monitoring for GGS.
- Provide escape ramps to and cover open trenches at the end of each work day.
- Restore disturbed aquatic and upland habitat to pre-action conditions.

Avoidance and Minimization – O&M Phase

- O&M activities would occur between May 1 and October 1 during the snake's active season to minimize impacts to the species.
- O&M personnel will participate in USFWS-approved worker environmental awareness program.
- A GGS survey would be conducted 24 hours prior to O&M activities in potential habitat. Should there be any interruption in work for greater than two weeks; a biologist would survey the project area again no later than 24 hours prior to the restart of work.
- GGS encountered during O&M activities will be allowed to move away from on their own.
- Movement of heavy equipment to and from the site will be restricted to established roadways. Stockpiling of O&M materials will be restricted to designated staging areas, which will be located more than 200 feet away from GGS aquatic habitat.

Riparian Brush Rabbit

Compensation for effects to riparian brush rabbit habitat would consist of activities to: (1) create and restore natural habitats, (2) improve or enhance habitat quality and (3) protect and preserve in perpetuity habitat and open space. Compensation for impacts to riparian brush rabbit would be provided at a ratio of 3:1 and may include both waterside and landside riparian habitat restoration or enhancement and preservation at a USFWS-approved site, which could include one or both of the proposed habitat compensation areas described below. All potential riparian brush rabbit habitat that are affected by project implementation would be compensated accordingly.

If occupied habitat would be affected, an Incidental Take Permit will be required and a separate consultation with USFWS under the FESA and with DFG under California ESA shall be conducted. These actions shall be separate from the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) and will require project-specific authorization and permitting. Specific mitigation measures shall be developed during the consultation process, including, but not limited to:

- Conducting preconstruction surveys;
- Conducting daily surveys of construction areas;
- Installing exclusion fencing to prevent brush rabbits from entering construction areas;
- Allowing trapping of riparian brush rabbits at the project site in support of the USFWS captive breeding program to establish new populations in appropriate habitat;
- Providing on site or off site compensatory mitigation for habitat loses.

These measures to minimize direct take in conjunction with compensation for adverse effects are anticipated to avoid a net reduction in the number of riparian brush rabbits. However, the potential loss of riparian brush rabbit population in the study area could restrict the range of this species because the RD 17 area currently contains the northernmost known extent of the population on the SJR.

Swainson's Hawk

To avoid and minimize effects to Swainson's hawk, USACE would implement the following BMP measures:

Before ground disturbance, all construction personnel would participate in a CDFG-approved worker environmental awareness program. A qualified biologist would inform all construction personnel about the life history of Swainson's hawk and the importance of nest sites and foraging habitat.

A breeding season survey for nesting birds would be conducted for all trees and shrubs that would be removed or disturbed which are located within 500 feet (0.5 miles for Swainson's hawk) of construction activities, including grading. Swainson's hawk surveys would be completed during at least 2 of the following survey periods: January 1 to March 20, March 20 to April 5, April 5 to April 20 and June 10 to July 30, with no fewer than 3 surveys completed in at least 2 survey periods and with at least 1 of these surveys occurring immediately prior to project initiation (Swainson's Hawk Technical Advisory Committee, 2000). Other migratory bird nest surveys could be conducted concurrent with Swainson's hawk surveys with at least 1 survey to be conducted no more than 48 hours from the initiation of project activities to confirm the absence of nesting. If the biologist determines that the area surveyed does not contain any active nests, construction activities, including removal or pruning of trees and shrubs, could commence without any further mitigation.

If active nests are found, USACE would maintain a 0.25-mile buffer between construction activities and the active nest(s). In addition, a qualified biologist would be present on site during construction activities to ensure the buffer distance is adequate and the birds are not showing any signs of stress. If signs of stress that could cause nest abandonment are noted, construction activities would cease until a qualified biologist determines that fledglings have left an active nest.

Other migratory birds also have potential to nest in or adjacent to the study area and would be significantly affected by construction activities. The following BMPs would be implemented:

Tree and shrub removal and other areas scheduled for vegetation clearing, grading or other construction activities would not be conducted during the nesting season (generally February 15 through August 31 depending on the species and environmental conditions for any given year). These construction activities could affect them by removing or causing abandonment of active nests of migratory birds protected under the Migratory Bird Treaty Act (MBTA) and CFGC. Implementation of minimization and avoidance measures described below would avoid, reduce or minimize the significant effect.

To reduce the impact on Swainson's Hawk habitat, USACE will seek a vegetation variance to allow preservation of vegetation on the waterside levee slope and levee toe, and where bank protection work is performed, the sites would be planted with vegetation and trees that will provide habitat for the hawks.

To compensate for the removal of acreage of riparian habitat supporting Swainson's hawks and other migratory birds, replacement habitat will be created as a mitigation area. For mitigation lands within the San Joaquin and Calaveras river systems, species selected to compensate for the riparian corridor removal will be consistent with the approved list of trees, shrubs and herbaceous plants native to the system. Additional mitigation may be planted in the expanded Mormon Channel Bypass (Old Mormon Slough) or on other lands within the Stockton area that provide similar value to those removed. Mitigation within the study area will prove to be contiguous and create habitat connectivity with wildlife migratory corridors that supports the needs of important native wildlife species without compromising the integrity of the flood control facilities. The exact location of the compensation lands in the study area would be coordinated in the design phase of the project with the sponsor and comply with the local SJMSCP objectives and goals.

It is assumed that sufficient lands would be available within the study area; however, if there is not sufficient land, other locations within the Stockton area would be identified and public coordination would occur.

Special Status Bird Species

USACE would conduct surveys to locate nest sites of the mentioned species in suitable breeding habitats in the spring of each construction year. Surveys would be conducted by a qualified biologist using survey methods approved by USFWS. Survey results would be submitted to USFWS before construction is initiated. If nests or young of these species are not located, construction may proceed. If nests or young are located, USACE would consult with USFWS and CDFW to determine what mitigation measures could be implemented to avoid or reduce potential disturbance-related impacts to these species. Measures could include a no-disturbance buffer zone established around the nest site. The width of the buffer zone would be determined by a qualified biologist in coordination with USFWS. No construction activities would occur within the buffer zone, which would be maintained until the young have fledged (as determined by a qualified biologist).

Burrowing Owl

Prior to initiation of any excavation activities at borrow sites, a preconstruction survey for burrowing owls would be completed in accordance with CDFW guidelines described in the Staff Report on Burrowing Owl Mitigation. If no burrowing owls are located during these surveys, then effects to burrowing owls would be less than significant and no mitigation would be required. If burrowing owls are located on or immediately adjacent to the site, then coordination would occur with CDFW to determine the proper measures that would need to be implemented to ensure that burrowing owls are not impacted by the project. Potential mitigation measures that could be implemented include:

- A CDFW-qualified biologist shall conduct appropriate surveys at and around material source sites, to determine the presence/absence of burrowing owls. At least one survey shall be conducted no more than one week prior to the onset of any construction activity.
- A 250-foot buffer, within which no new activity would be permissible, would be maintained between project activities and nesting burrowing owls. This protected area would remain in effect until August 31 or at CDFW discretion, until the young owls are foraging independently.
- No burrowing owls could be evicted from burrows during the nesting season (February 1 through August 31). Eviction outside the nesting season could be permitted pending evaluation of eviction plans and receipt of formal written approval from CDFW authorizing the eviction.
- If accidental take (disturbance, injury or death of owls) occurs, the DFG would be notified immediately.
- Conduct mandatory worker awareness training for construction personnel.

Special Status Bat Species

The following measures would be implemented to reduce short term impacts to special status bat species from construction of the proposed alternatives:

- A qualified biologist would examine trees for suitable bat roosting habitat before removal or trimming. High quality features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees, with intact thatch, etc.) would be identified and the area around these features would be searched for bats and bat signs (guano, culled insect parts, staining, etc.). If suitable habitat and/or bat signs are detected, biologists would conduct evening visual emergence surveys from half an hour before sunset to 1 to 2 hours after sunset for a minimum of 2 nights. The survey shall be conducted no more than one week prior to the onset of any construction activity. If no bat roosts are located, no further mitigation is necessary.
- If active roosting western red bats are identified within the survey area, CDFW shall be immediately notified to determine what mitigation measures could be implemented to avoid or reduce potential disturbance-related impacts to these species.

5.12.10.2 Special Status Plant Species

Before project construction, surveys for special-status plants in Table 5-35 shall be conducted by a qualified botanist at the appropriate time of year when the target species would be in flower or otherwise clearly identifiable. Surveys shall be conducted in accordance with specific guidelines described by Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (CDFG, 2009).

If special-status plants are found, the following measures shall be implemented:

- Qualified botanists would survey the biological study area to document the presence of special-status plants before project implementation and would conduct a floristic survey that follows the CDFW botanical survey guidelines (CDFG 2009). All plant species observed would be identified to the level necessary to determine whether they qualify as special-status plants or are plant species with unusual or significant range extensions. The guidelines also require that field surveys be conducted when special-status plants that could occur in the area are evident and identifiable, generally during the reported blooming period. To account for different special-status plant identification periods, one or more series of field surveys may be required in spring and summer. If any special-status plants are identified during the surveys, the botanist would photograph and map locations of the plants, document the location and extent of the special-status plant population on a CNDDB Survey Form and submit the completed Survey Form to the CNDDB. The amount of compensatory mitigation required would be based on the results of these surveys.
- If one or more special status plants is identified in the biological study area during preconstruction surveys, the sponsor would redesign or modify the proposed project components to avoid indirect or direct effects on special status plants wherever feasible. If special status plants cannot be avoided by redesigning projects, implementation of mitigation, (avoidance, and minimization, and compensatory) would avoid significant effects on special status plants.
- If complete avoidance of special status plants is not feasible, the effects of the project on special status plants would be compensated through off site preservation at a ratio to be negotiated with the resource agencies. Suitable habitat for affected special-status plant species would be purchased in a conservation area, preserved and managed in perpetuity. Detailed information would be provided to the agencies on the location and quality of the preservation area, the feasibility of protecting and managing the area in perpetuity and the responsible parties. Other pertinent information also would be provided, to be determined through future coordination with the resource agencies.

5.12.10.3 Special Status Fish Species

See also the conservation measures and mitigation associated with SRA and riparian habitat addressed in VEGETATION (Section 5.9), WILDLIFE (Section 5.10) and the BMPs associated with construction-related impacts such as dust, runoff and spills addressed in WATER QUALITY (Section 5.5).

Avoidance and Minimization Measures – Construction Phase

- Use BMPs to prevent slurry seeping out to river and require piping system on land side only.
- Stockpile construction materials such as portable equipment, vehicles and supplies at designated construction staging areas and barges, exclusive of any riparian and wetlands areas.
- Stockpile all liquid chemicals and supplies at a designated impermeable membrane fuel and refueling station with a 110 percent containment system.
- Implement erosion control measures (BMPs) including Stormwater Pollution Prevention Program and Water Pollution Control Program that minimize soil or sediment from entering the river. Install, monitor and maintain BMPs for effectiveness throughout construction operations to minimize effects to Federally listed fish and their designated critical habitat.
- Schedule construction when listed terrestrial and aquatic species would be least likely to occur in the project area. If construction needs to extend into the timeframe that species are present, coordinate with the resource agencies.
- Limit site access to the smallest area possible in order to minimize disturbance.
- Remove litter, debris, unused materials, equipment and supplies from the project area daily. Deposit such materials or waste at an appropriate disposal or storage site.
- Immediately (within 24 hours) clean up and report any spills of hazardous materials to the resource agencies. Report any such spills and the success of the efforts to clean them up, in post-construction compliance reports.
- Designate a USACE-appointed representative as the point-of-contact for any contractor who might incidentally take a living or find a dead, injured or entrapped, threatened or endangered species. Identify this representative to the employees and contractors during an all employee education program conducted by USACE.
- Screen any water pump intakes, as specified by NMFS and USFWS screening specifications. Water pumps will maintain flows to keep approach velocity at the pump screens at 0.2 feet per second or less when working in areas that may support delta smelt or juvenile salmonids.

The following measures would be implemented during construction of the proposed Fourteenmile Slough and Smith Canal closure structures to reduce potential adverse effects on ESA listed species, other native fish species and their habitats.

- All in-water construction activities would be limited to the period of June 1 through October 31 to avoid the primary migration periods of listed salmonids.
- In-water pile driving would be restricted to July 1 through September 30 to avoid or minimize exposure of adults and juvenile salmonids to underwater pile-driving sounds.
- All pile driving would be conducted by a vibratory pile driver to minimize underwater sound levels during pile-driving operations.
- Pile driving would be conducted by barge to minimize disturbance of riparian habitat.
- Conduct underwater noise monitoring during in-water construction to validate established noise thresholds are not exceeded (agreement with CDFG, USFWS, and NMFS).

Additional Minimization and Conservation Measures

To further avoid and minimize project effects on listed species and their critical habitat USACE would pursue the following additional measures during PED and prior to construction:

- Where suitable, pursue a vegetation variance that would allow woody vegetation to remain on the lower waterside portion of the levee and within the 15' waterside vegetation-free zone (where removal is not otherwise required for construction of the levee improvements, floodwall or closure structures).
- USACE will seek opportunities during the design phase of the project to establish SRA compensatory mitigation if a vegetation variance is approved.
- Compensation for the permanent loss of 19,630 lf of SRA would occur through the purchase of credits at a mitigation bank, if onsite mitigation is not feasible.
- Minimize vegetation removal to the extent feasible.
- Minimize, to the extent possible, grubbing and contouring activities.
- Identify all habitats containing or with a substantial possibility of containing, listed terrestrial, wetland and plant species in the potentially affected project areas. To the extent practicable efforts will be made to minimize effects by modifying engineering design to avoid potential direct and indirect effects.
- Incorporate sensitive habitat information into project bid specifications.
- Incorporate requirements for contractors to avoid identified sensitive habitats into project bid specifications.

5.13 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

This section describes the affected environment and environmental consequences relating to socioeconomics and environmental justice as well as the significance of the impacts and mitigation measures to reduce impacts.

5.13.1 ENVIRONMENTAL SETTING

Regulatory Framework

The assessment of socioeconomic resources is guided primarily by Federal laws and policies, while State and local plans and policies, including local general plan housing elements, typically promote economic development and diversity, public health and safety, housing and other concerns of the communities and resident within their jurisdictions. Environmental justice issues are mandated and regulated primarily at the Federal level. The major regulations concerning socioeconomic resources and environmental justice relevant to the proposed action are described below.

Federal

- Executive Order 12898: Environmental Justice
- Uniform Relocation Assistance and Real Property Acquisition Policies Act

State

- California Code Chapter 16: Relocation Assistance

Local

- City of Lathrop General Plan (2004)
- City of Stockton General Plan (2007)
- San Joaquin County General Plan (2007)
- City of Manteca General Plan (2013)

Environmental Justice

EO 12898, Environmental Justice, was issued in 1994. Objectives of the EO, as it pertains to this assessment, include development of Federal agency implementation strategies and identification of minority and low-income populations where proposed Federal actions have disproportionately high and adverse human health and environmental effects.

Minority populations are those persons who identify themselves as Black or African American, Hispanic, Asian American, American Indian/Alaskan Native or Pacific Islander. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 2010 are those whose income are $22,050 for a family of four and are identified using the Census Bureau's statistical poverty threshold. USCB defines a "poverty area" as a Census tract with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level. This is significant because the social and economic welfare of minority and low-income populations may be positively or disproportionately impacted by the proposed action alternatives and because of public concerns regarding the fair and equitable treatment (meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies and actions.

Existing Conditions

The first two areas of concern in the study area, central and north Stockton, are located in what the U.S. Census Bureau (USCB) refers to as the Stockton Subdivision. The third area, RD 17, is located in both the Stockton Subdivision and the Manteca Subdivision. Stockton is the seat of San Joaquin County, one of the richest agricultural and dairy regions in California. The region is the top statewide producer of asparagus and also supports a growing wine industry. Historically, Stockton's agricultural economy has diversified to include industrial and manufacturing operations, including sulfur production. With its proximity to Interstate 5, other major highways and two transcontinental rail lines, the Port of Stockton is a major economic hub and the only port facility in California whose export tonnage exceeded import tonnage in 2011. For comparison, Table 5-37 shows the same demographic information for the State of California, San Joaquin County and the Cities of Stockton, Lathrop and Manteca.

The following analysis is based on *Environmental Justice, Guidance Under the National Environmental Policy Act*, prepared by CEQ and the Executive Office of the President (CEQ 1997). Although none of the published guidelines define the term "disproportionately high and adverse," CEQ includes a non-

quantitative definition stating that an effect is disproportionate if it appreciably exceeds the risk or benefit rate to the general population.

Under the CEQ guidelines, the first step in conducting an environmental justice analysis is to determine the presence of minority and low-income populations. The second step requires that the Federal agency determine if the Federal action would result in disproportionately high or adverse health or environmental effects. The CEQ guidance indicates that when determining whether the effects are high and adverse, agencies are to consider whether the risks or rates of impact "are significant (as employed by NEPA) or above generally accepted norms." The environmental justice analysis is based on a review of relevant demographic data to define the relative proportion of minority and low-income populations in Stockton and RD 17 (Lathrop and Manteca) to determine whether the LSJR Project would result in environmental justice effects on the relevant populations.

This section compiles demographic data on income and minority status for Stockton, Lathrop and Manteca and compares this data with the demographic profiles of San Joaquin County and California to determine if Stockton, Lathrop and Manteca contain significant minority or low-income populations.

San Joaquin County

Demographics

Approximately 78 percent of the San Joaquin County population resides in cities, 43 percent in Stockton. The majority of San Joaquin County's population growth between the years 2000 and 2008 occurred in incorporated areas, particularly the Cities of Lathrop, Ripon, Tracy and Manteca (AECOM, 2011:3.3-8). Stockton, Lathrop and Manteca are within the study area.

According to the 2010 Census, San Joaquin County has a population of 685,306. San Joaquin county's population has 68.4 percent white alone, 8.2 percent Black or African American, 2 percent American Indian and Alaska Native, 15.7 percent Asian, 0.7 Native Hawaiian and other Pacific Islander, 39.7 percent Hispanic or Latino and the remaining 5 percent classified as other or more than one ethnic group. The per capita income in San Joaquin County is $31,624 and the average salary per worker is $48,807. There are 17.5 percent of the people below the poverty level, which is more than the statewide average of 15.3 percent and less than the poverty threshold. The San Joaquin economy is more diverse, primarily as a result of its proximity to Sacramento County and the Bay Area.

Between 2006 and 2011, the population of San Joaquin County grew at an annual average rate of 1.0 percent. This growth is almost entirely due to the natural increase, as net migration ground to a halt. However, net migration is expected to increase over the next few years as job growth attracts new residents. The projected annual population growth in the 2012 to 2017 period averages 1.7 percent per year. The majority of the population is located in the city of Stockton with 291,707 residents. Manteca and Lathrop are two other major cities associated with the project and have 66,451 and 17,429 residents respectively. As mentioned earlier, Stockton has the highest percentage of its population below the poverty level out of all the other cities in San Joaquin County.

Housing

Since 2007, the San Joaquin County Housing market changed. Prices dropped and the foreclosure rate leads the country. As of September 2008, the California Association of Realtors reports that the median home price dropped from the 2006 high of $250,000 to $190,000 (SJCOG) (AECOM, 2011:3.3-9).

Local Economy

San Joaquin County is the northernmost county in the San Joaquin Valley. Stockton is the key urban center. The County is located in Northern California's growth corridor. It is increasingly linked to the San Francisco Bay Area by virtue of its location and re-location of workers and companies (SJC 2010:24). Among the county's most important assets are the Stockton Airport and the Port of Stockton.

Agriculture was historically the County's main economic sector and remains a basic industry. Between 1970 and 2000, direct agricultural employment in the Valley dropped from 15 percent of the total to only 8.4 percent, while agricultural services employment quadrupled (SJC, 2010:25). Growth in agricultural services employment was mainly due to high value crops, like wine, walnuts and almonds (SJC, 2010:25). In 2007, farm production exceeded $2 billion (SJCCOG, 2008:1). Other large economic sectors in the county include transportation, warehousing, professional services and wholesale and retail trade.

Stockton

Stockton is the largest city in San Joaquin County and also the 13th largest city in California. According to the 2010 Census, Stockton's population is made of 37 percent white alone, 12.2 percent Black or African American, 1.1 percent American Indian American Indian and Alaska Native, 21.5 percent Asian, 0.6 Native Hawaiian and other Pacific Islander, 40.3 percent Hispanic or Latino and the remaining 6.9 percent classified as other or more than one ethnic group. More than 50 percent of the population in Stockton are minorities and has 23.3 percent of the population living below the poverty line. Additionally, important information on the population's location shows that 285,973 people (98 percent of the population) lived in households, 3,896 (1.3 percent) lived in non-institutionalized group quarters and 1,838 (0.6 percent) were institutionalized.

The median sales price for a home in Stockton in 2011 was $157,000 compared to the statewide median of $355,600. The median household income for Stockton in 2011 was $44,310 and $57,287 for the California. The Stockton population density is 4,504.96 residents per square mile, much higher than the national average density of 81.32 residents per square mile. The population growth is much higher than the State average of 9.99 percent and is slightly higher than the National average of 9.71 percent.

On June 28, 2012, the City of Stockton filed a petition for Chapter 9 Bankruptcy protections with the United States Bankruptcy Court in Sacramento, California. The majority of the city's budget is not impacted by the fiscal crisis. The total budget of $521 million includes $361 million in restricted funds, which cannot be used to resolve the General Fund Crisis. The $160 million General Fund provides for services such as police, fire, libraries, parks maintenance and administrative functions. These essential services would be protected for safety and welfare. The construction of setback and improvement of existing levees would not have any adverse effect on any particular group, but protect all within the floodplain equally. And since DWR and SJAFCA would be the non-Federal cost sharing partners for the project, the levee improvements would not have any significant economic effect on the population.

Lathrop

Lathrop is located in San Joaquin County, California. According to the 2010 Census data, the total Lathrop population is 18,023, which has grown 72.55 percent since 2000. The city has 21.93 square miles of land area and 1.10 square miles of water area. Lathrop population is 41.1 percent white alone, 7.2 percent Black or African American, 1.3 percent American Indian American Indian and Alaska Native, 22 percent Asian, 0.8 Native Hawaiian and other Pacific Islander, 42.6 percent Hispanic or Latino and the remaining 6.9 percent classified as other or more than one ethnic group. Lathrop only has 7.4 percent of the population below the poverty line.

Lathrop median household income is $62,255 in 2008-2012 and has grown by 13.11 percent since 2000. The income growth rate is much lower than the state average of 29.28 percent and is much lower than the national average of 26.32 percent. It has a median house value of $199,400 in 2008-2012. The house value growth rate is much lower than the State average of 81.51 percent and is much lower than the National average rate of 51.67 percent.

Manteca

As of 2010, the total Manteca population is approximately 67,096. The population is 32.4 percent white alone, 4.3 percent Black or African American, 1.1 percent American Indian and Alaska Native, 7.1 percent Asian, 0.6 Native Hawaiian and other Pacific Islander, 37.7 percent Hispanic or Latino and the remaining 7.2 percent classified as other or more than one ethnic group. Manteca has 9.7 percent of the population below the poverty line.

Manteca median household income was $62,411 from 2008 to 2012. The income growth rate is higher than the State and National averages. Average house value is $225,700, up 44.59 percent since 2000.

Table 5-37: Race/Origin Characteristics and Poverty Status by City/County/State, 2010 (Percent)

Race Origin	City of Stockton	City of Lathrop	City of Manteca	San Joaquin County	State of California
Race					
White	37.0	41.1	32.4	68.4	73.7
Black or African American	12.2	7.2	4.3	8,2	6.6
American Indian and Alaska Native	1.1	1.3	1.1	2.0	1.7
Asian	21.5	22.0	7.1	15.7	13.9
Native Hawaiian, other Pacific Islander	0.6	0.8	0.6	0.7	0.5
Two or more ethnicities	6.9	6.9	7.2	5.0	3.6
Origin					
Hispanic	40.3	42.6	37.7	39.7	38.2
Population Below Poverty Line					
Percent of Total Population	23.3	7.4	9.7	17.5	15.3

Source: USCB 2010 and ACS 5-Year Estimates, 2008-2012.

5.13.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This evaluation of socioeconomics and environmental justice is based on professional standards and information cited throughout the section. NEPA and CEQA requirements of social and economic effects are somewhat different. NEPA requires social and environmental 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 (CEQ Guidelines Sec. 15064[f]).

The key effects were identified and evaluated based on the environmental characteristics of the LSJR project area and the magnitude, intensity and duration of activities related to the construction and operation of this project.

Basis of Significance

Implementation of a project alternative would have a significant impact with regard to population, housing and employment if it would:

Induce substantial unplanned population growth in an area, either directly or indirectly;

- Result in a disproportionate effect on minority or low income communities;
- Substantial change in employment;
- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere;
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere; or
- Physically divide an established community.

Implementation of a project alternative would have a significant impact with regard to environmental justice if it would have substantial and disproportionate adverse effects on the social and economic welfare of minority or low-income populations. A potential disproportionate impact may occur when the percent of minorities in the affected project area exceeds 50 percent and/or the percent of low-income exceeds 20 percent of the population or meaningfully greater than those in California. The 2010 census data indicated that the State of California, San Joaquin County and the Cities of Lathrop and Manteca all had less than 20 percent of the population below the poverty level. Furthermore, the poverty rate in Stockton is 23.3 percent, qualifying it for the USCB definition of a "poverty area." Stockton also has a higher percentage of minorities relative to the State of California and San Joaquin County (Table 5-37).

Effects and Mitigation Measures

5.13.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, the FRM project would not be implemented. The current level of risk would remain for a major levee failure and flooding of areas within north and central Stockton and RD 17. Depending on the location and severity of the levee failure and duration of flooding, the location and extent of damage and impacts on existing residential, commercial, industrial and agricultural structures behind the existing levees could be from minor to extensive. Levee failure and subsequent inundation would have the potential to cut off access to certain portions of the affected communities. Levee failure and subsequent inundation would require temporary or permanent relocation of residents and businesses to nearby communities. Figures 5-7 and 5-8 show estimated flood depths in the study area in the event of a levee failure.

Under the No Action Alternative, none of the proposed flood risk reduction improvements would be implemented. The Stockton General Plan anticipates continued growth within Stockton's sphere of influence (SOI) and planning area (Figure 5-15) with the development of a mixture of commercial, residential and public spaces suitable for local residents through planned zoning and extension of services and establishes guidelines and regulations to minimize the impacts of growth on human and environmental resources. Flooding would continue to result in short term and minor restrictions of connectivity between rural and urban areas; however, the current risk of flooding, as represented by conditions in the study

analysis area, would continue to pose a threat to both residents and property in and near the Cities of Stockton, Lathrop and Manteca.

A flood event could have severe consequences for agriculture and land use in the study area, thereby affecting economic productivity. Flooding could result in substantial damage to private and public property, loss of personal income and loss of public tax revenue. An estimated 235,000 residents and $28.7 billion in damageable property would continue to be at risk of unexpected levee failure and flooding in the study area. Flooding under the No Action Alternative would displace housing and people, necessitating the construction of replacement housing. Further, because Stockton, Lathrop and San Joaquin County are more than 50 percent populated by minorities and the poverty rate is more than 20 percent in Stockton; adverse effects on the economic welfare of the community would essentially affect the low income and minority population.

This has the potential to be a significant and unavoidable impact; however since the potential timing of these events and location of levee breaches cannot be predicted, this impact is likely **too speculative for meaningful consideration** based on available information.

5.13.4 ALTERNATIVES 7A, 8A AND 9A

Alternatives 7a, 8a and 9a consist primarily of improving existing levees in north and central Stockton, constructing two floodgates, one in Fourteenmile Slough and one at Smith Canal and constructing a flood wall at the entrance to Smith Canal at Dad's Point. Alternative 9a also includes a flood bypass through Old Mormon Slough, which is located in central Stockton. Construction, operation and maintenance of these components of the three alternatives would result in temporary and permanent impacts on properties immediately adjacent to the levees, gates and the flood wall at Dad's Point. These impacts would be **significant** because they could adversely impact occupants and the value of individual properties or neighborhoods that are directly and permanently affected by changes in the levee footprint and/or easement. Impacts would be reduced to **less than significant** with mitigation. Mitigation measures are identified in Section 5.13.6.

All three alternatives would provide the same level of flood risk reduction to north Stockton. Alternative 8a would significantly reduce flood risk to all of central Stockton. Alternative 9a would reduce flood risk to all of central Stockton but would provide somewhat less risk reduction to portions that are near the Stockton Diverting Canal. Alternative 7a would reduce flood risk to all of central Stockton, but to a lesser degree than either Alternative 8a or Alternative 9a. By reducing the risk of flooding, the project would result in positive impacts to socioeconomics by reducing the likelihood of flooding, loss of lives, pain and suffering. The project would also reduce the cost of flood insurance to structures removed from the 100-year FEMA floodplain. Alternatives 7a, 8a and 9a would be an overall **beneficial** impact to local and regional socioeconomics.

Alternatives 7a, 8a and 9a would all reduce flood risk to the city of Stockton. Stockton has a higher percentage of minorities relative to the State of California and any other city in San Joaquin County. It also has large number of households living below the poverty line. None of these alternatives would create new barriers that would divide any established community or disproportionately impact minority or low income populations. The FRM project would benefit all residents in north and central Stockton in that it would reduce flood risk.

Alternatives 7a, 8a and 9a would not address flood risk in RD 17. Because Lathrop (located in RD 17) is more than 50 percent populated by minorities, adverse effects on the economic welfare of the community would essentially affect a minority population. This would leave Alternative 1 - No Action impacts in effect.

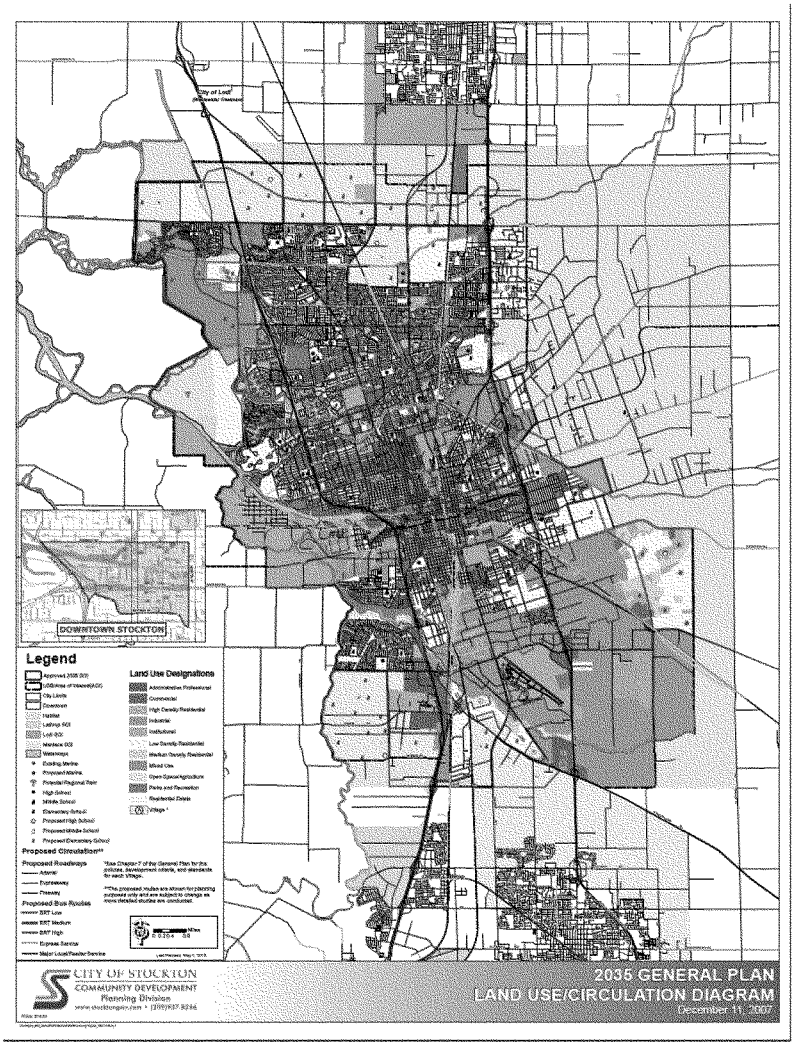


Figure 5-15: 2035 General Plan Land Use/Circulation Diagram

5.13.5 ALTERNATIVES 7B, 8B AND 9B

Alternatives 7b, 8b, 9b include the same levee improvements and gates, floodwall and flood bypass (9a and 9b only) as are described for Alternatives 7a, 8a and 9a, above. However, in addition the "b" alternatives include levee improvements to the northern, western and southern levees in RD 17 and construction of a new levee extension in the southern part of the RD 17. The improvements in RD 17 would be the same for Alternatives 7b, 8b and 9b. Construction, operation and maintenance of these alternatives would impact some properties immediately adjacent to the levees, gates and the flood wall at Dad's Point. These impacts would be **significant** because they could adversely impact occupants and the value of individual properties or neighborhoods that are directly and permanently affected by changes in the levee footprint and/or easement. These impacts would be **less than significant** with mitigation.

None of these alternatives would create new barriers that would divide any established community, displace existing housing or displace people, and would not disproportionately impact minority or low income populations.

Alternatives 7b, 8b and 9b would reduce flood risk to residents and businesses in north and central Stockton and in RD 17, including the Cities of Manteca and Lathrop. Residents in these areas would be removed from the 100-year FEMA floodplain and, therefore, would benefit over the long-term from reduced flood insurance costs. By reducing flood risk to RD 17, barriers to implementing planned development would be removed. In addition, lands currently in agriculture and open space would become subject to increased development pressure. Conversion of agricultural and open space lands to urban uses would be a **beneficial** impact to socioeconomics to the extent that it permitted implementation of approved land use plans. This would produce an overall **beneficial** impact to local and regional socioeconomics.

Alternatives 7b, 8b and 9b would all reduce flood risk to the Cities of Stockton, Lathrop and Manteca. Stockton has a higher percentage of minorities relative to the State of California and any other city in San Joaquin County. It also has large number of households living below the poverty line. Lathrop is more than 50 percent populated by minorities. None of these alternatives would create new barriers that would divide any established community or disproportionately impact minority or low income populations. The FRM project would benefit all residents in Stockton and in RD 17, including Lathrop and Manteca, in that it would reduce their flood risk.

5.13.6 MITIGATION

Project planning for all of the action alternatives has included attention to avoiding and minimizing potential impacts to adjacent properties to the extent feasible in consideration of the FRM goals of the study. Potential significant adverse impacts to adjacent properties would be mitigated through appropriate compensation. If relocation of people or their homes are required, they would be compensated under the Federal Relocation Act. With mitigation, the potentially significant impacts to adjacent property owners of implementing Alternatives 7a, 8a, 9a, 7b, 8b and 9b would be reduced to **less than significant**.

5.14 LAND USE

This section describes the affected environment and environmental consequences relating to land use for the LSJR project as well as the significance of the impacts and mitigation measures to reduce impacts.

5.14.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to land use are listed below and summarized in Chapter 7.

Federal

- Executive Order 11988, Floodplain Management
- Farmland Protection Policy Act (FPPA)
- Federal Relocation Act

State

- California Land Conservation Act of 1965 (Williamson Act)

Local

- San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP) (SJCOG 2000)
- City of Lathrop General Plan (2004)
- City of Stockton General Plan (2007)
- San Joaquin County General Plan (2007)
- City of Manteca General Plan 2023 (2013)

Existing Conditions

The headwaters of San Joaquin watershed are mountainous and in open space usage. Downstream, land use within the floodplain is characterized by scattered rural-residential development and isolated centers of urban development surrounded by extensive agricultural development.

Stockton and RD 17

The city of Stockton has commercial, government, industrial and residential areas. It is the fourth most populous city in California's Central Valley. Residential uses are concentrated in the north, above the Lower Calaveras River and civic, business and industrial uses are concentrated to the south. The area south of the Lower Calaveras River is considered downtown Stockton and consists of commercial and government uses. The Stockton Deep Water Ship Channel, located in the southern portion of the city, plays an important role in the import and export of agricultural supplies and commodities.

Stockton has established three increasingly inclusive areas that define the extent of planning efforts relative to anticipated development over time (Figure 5-16). The city boundary defines the area of lands that are already annexed. The sphere of influence (SOI) defines the city's physical limits and service areas. The proposed SOI defines the area expected to be annexed and developed for urban land use by 2035. The Stockton General Plan anticipates and plans for a mixture of urban development, including commercial, industrial, residential and other uses.

The Weston Ranch development is an existing residential development located in the northern portion of RD 17. The Weston Ranch development is primarily low density residential with scattered services and schools. In the southern portion of RD 17, land uses are primarily pasture, row crops and orchards. According to the Stockton General Plan (2007), the area just south of Weston Ranch is planned for development including villages, commercial, administration professional and industrial uses. Villages include many different categories of housing and services with mixed densities.

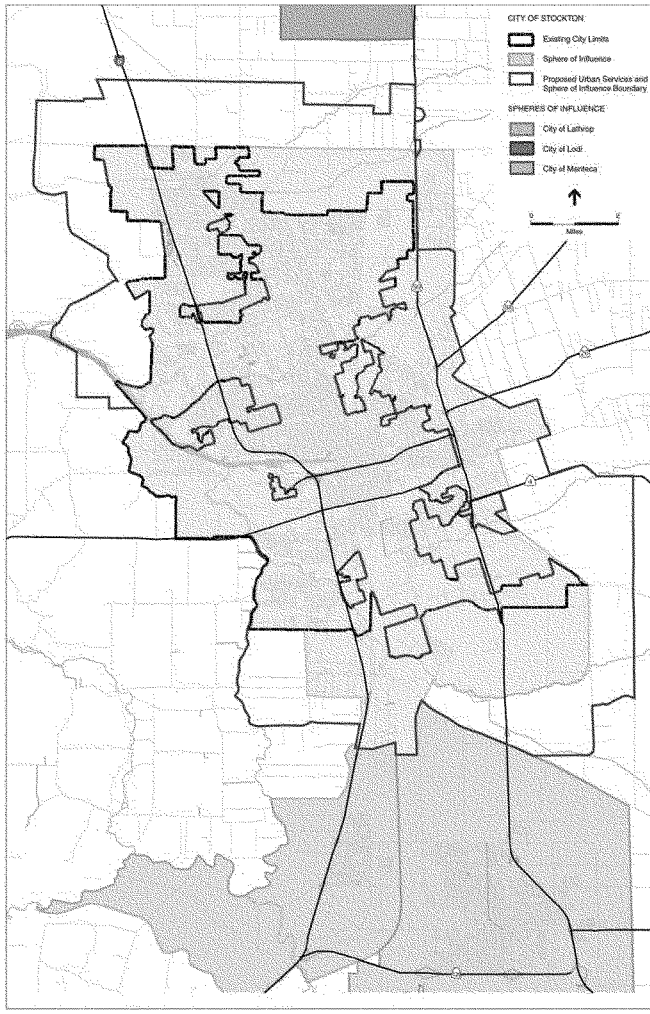


Figure 5-16: Stockton Planning Boundaries
Source: City of Stockton 2007a.

Agriculture

The California Land Conservation Act of 1965, commonly referred to as the Williamson Act, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. In return, landowners receive property tax assessments, which are much lower than normal because they are based upon farming and open space uses as opposed to full market value. Local governments receive an annual subvention of forgone property tax revenues from the State via the Open Space Subvention Act of 1971. In 1998, the California Legislature enhanced the Williamson Act with the Farmland Security Zone (FSZ) provisions. These provisions offer landowners greater property tax reduction in return for a minimum rolling contract term of 20 years (CDC, 2010:1) In 2009, San Joaquin County had 60,059 acres (11.24 percent) of its contracts in FSZ's. State financial support for the Williamson Act was recently eliminated; however, Senate Bill 863 was passed in 2010 as a short term solution for preserving the program. As of January 1, 2011, counties are allowed to establish new contracts with a reduction in terms from 10 to 9 years and a reduction of tax benefits by 10 percent. In 2008, 6,600 acres equaling almost 70 percent of the agricultural parcels in San Joaquin County, were covered by Williamson Act Contracts (Figure 5-17). Of these, 552 parcels were within the Stockton SOI. 5.8 percent of all enrolled acres in the county were subject to notices of nonrenewal in 2006 (San Joaquin County, 2009). Nonrenewals are often filed with the anticipation of converting farmland to other uses (CDC, 2010:7). Since 2008, San Joaquin County has shown a decrease in contract renewals.

The San Joaquin County General Plan (2007) designates 83.2 percent of lands outside of the accepted Spheres Of Influence for Lodi, Stockton, Lathrop and Manteca as agricultural and outlines a number of policies concerning its governance of land use within the county. It is the county's policy, among others, to: *(1) restrict the use of lands designated as agricultural to uses that are compatible with agricultural practices, including natural resource management, open space, outdoor recreation and enjoyment of scenic beauty; (2) protect the riparian habitat along the rivers and natural waterways to the extent possible; (3) deny all uses that intrude into or are located adjacent to an agricultural area if they are detrimental to continued agricultural usage of the surrounding area; (4) promote and protect agriculture as the primary industry of the county; (5) minimize conflict between various land uses resulting from urban expansion; and, (6) promote the diversification and growth of the local economy.*

Stockton adopted a right-to-farm ordinance (Municipal Code Section 16.36.040) that recognizes that agricultural operations frequently become the subjects of nuisance complaints and seeks to reduce the premature conversion of farmland by clarifying the circumstances under which an agricultural operation may be considered a nuisance. The ordinance declares it the policy of Stockton that commercial agricultural uses in the SOI or areas not annexed by Stockton, are a priority use and inconveniences or discomforts arising from such shall not be a nuisance. The ordinance also requires discretionary development approvals to require a good faith effort to coordinate with adjacent agricultural operations to reduce potential conflicts.

There are no NRCS conservation easements on lands in the study area.

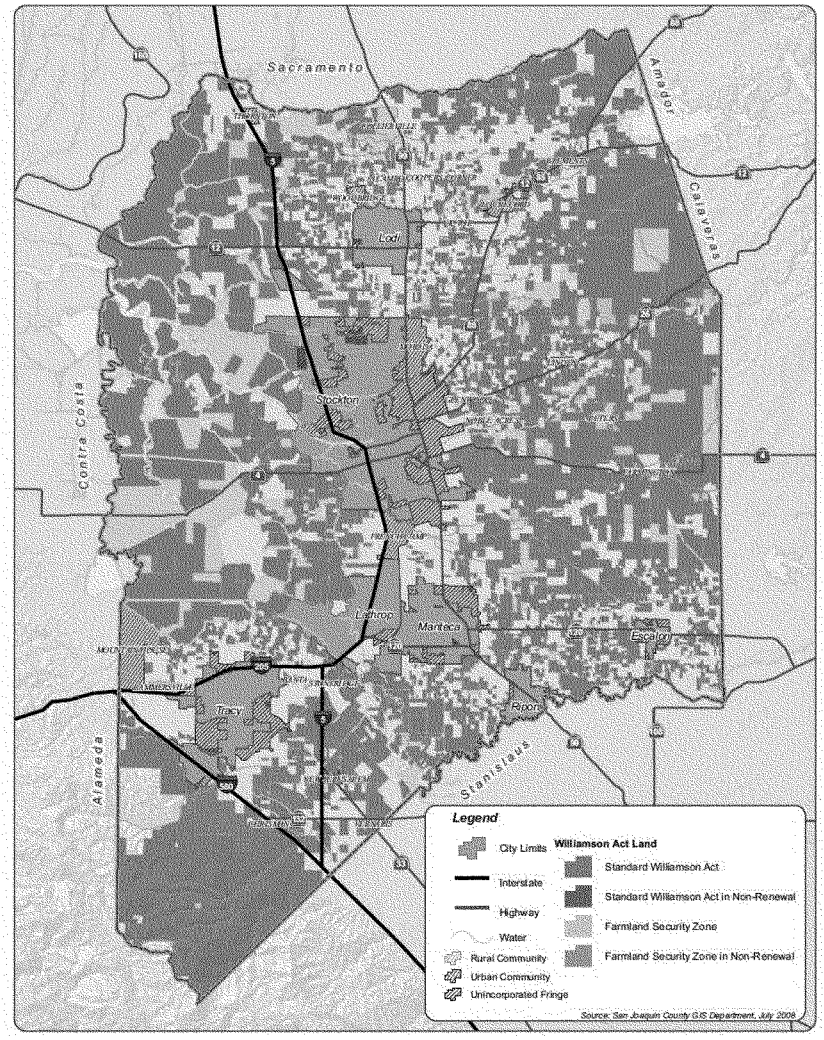


Figure 5-17: Williamson Act Contracts in the Study Area

Stockton General Plan

The Stockton General Plan is a land use and development plan that is required by state law. These regulations are designed to allow Stockton to manage growth while providing expanded employment opportunities, creating a mix of housing and supporting uses and ensuring that impacts to natural and cultural resources are avoided or minimized. While city policies support continued agricultural uses, provide funding for agricultural and open space programs, reduce conflicts between agricultural and urban uses and coordinate regional efforts to preserve farmland within San Joaquin County, the Stockton General Plan proposes land use changes to existing zoning that would result in substantial conversion of farmland to non-agricultural uses.

The San Joaquin Local Agency Formation Commission (LAFCO) cannot approve Stockton's proposed changes to its SOI if the area includes lands under a Williamson Act contract. Section 56426.5 of the California Code of Regulations allows LAFCO to approve a change to the SOI when the area includes land under a Williamson Act contract if certain findings can be made. One of the findings that can be made is that "the change would facilitate planned orderly and efficient patterns of land use or provision of services and the public interest in the change substantially outweighs the public interest in the current continuation of the contract beyond its current expiration date." Because the Stockton General Plan provides for the planned orderly and efficient use of land, requiring the development of master plans prior to the development of most of the non-urbanized land within the proposed SOI, LAFCO could make the finding necessary to approve the proposed expanded SOI. The current SOI for the City of Stockton was approved by LAFCO in September 2008.

The policies and actions of Stockton's General Plan would result in the conversion of up to 17,230 acres of Prime Farmland, 1,260 acres of Unique Farmland and 3,190 acres of Farmland of Local Importance to non-agricultural uses and constitute a significant impact on these valuable resources (City of Stockton, 2007). The majority of farmlands within Stockton's SOI are not located within the FEMA 100-year floodplain and development of these lands is not limited by lack of available flood insurance. Once contracts expire, these lands are likely to be developed for commercial or residential use to compensate for the substantial increase in property taxes. San Joaquin County has designated most of the undeveloped lands within the proposed Stockton SOI as agricultural lands. However, these lands could be zoned for development once annexed by Stockton.

New development within the Stockton SOI would minimize potential incompatibilities between agricultural and urban uses through the careful allocation of land uses, the layout of roads, parks and public facilities, density controls and transfers, design guidelines for buildings and public and private improvements and possibly the use of buffers that restrict uses adjacent to agricultural land. Agriculture is a significant socioeconomic driver in the study area and surrounding region and it is important to Stockton residents that new development minimizes loss of agricultural land. The Stockton General Plan contains a number of policies that provide for the long term preservation and orderly conversion of farmland within Stockton's SOI and planning area. There are currently no development or flood risk reduction projects planned for the areas outside the proposed SOI.

ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature and accepted standards of professional practice.

Basis of Significances

A project alternative would create a significant land use impact if it would:

- Conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project and adopted for the purpose of avoiding or mitigating an environmental effect;
- Conflict with any applicable habitat conservation plan or natural community conservation plan; or
- Result in unnecessary and unavoidable conversion of substantial areas of Prime Farmland, Unique Farmland or Farmland of Local Importance to nonagricultural use.

Effects and Mitigation Measures

5.14.2 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, USACE would not construct the project and the city of Stockton and surrounding areas would continue to be at risk of flooding. A catastrophic flood event could result in damage to homes, City and County government facilities and many other properties. The Stockton General Plan would be implemented and development within RD 17 would occur as planned. While the RD 17 area is currently FEMA certified, this area would still be protected by levees and would remain at risk of flooding. If a levee failure or flood event were to occur, this urban area could be at risk of additional flood-related damages.

Stockton would continue to enforce its Right-to-Farm Ordinance (Municipal Code Section 16.36.040), that protects owners of agricultural land at the urban fringe from unwarranted nuisance suits brought by surrounding landowners and provides for resolution of urban-agricultural disputes. An Agricultural Mitigation Fee would be implemented as a private, market-based approach to mitigate the loss of agricultural land. The mitigation fee would be used to acquire easement or fee interest in agricultural land that restricts the use to agricultural production in perpetuity. These measures would reduce and partially offset farmland conversion impacts. Nonetheless, even with the mitigation fee, design provisions, agricultural buffer and Right-to-Farm Ordinance included in the proposed General Plan, a substantial area of Prime Farmland would be converted to urban uses.

The proposed urban land use designations contained in the city limits and proposed SOI would in time lead to the conversion of farmland to urban uses as the Stockton General Plan is implemented. The Stockton General Plan designates agricultural land within the SOI and on Urban Reserve lands outside the SOI as supporting urban uses in the future. As a result of these urban designations, owners of farmland under Williamson Act contracts may be encouraged to file for non-renewal or early cancellation of their contracts in anticipation of developing their properties.

The No Action Alternative could result in scouring of agricultural land and the long-term loss of topsoil in areas within several hundred feet of the levee breach, which could result in long-term loss of Important Farmland in those areas. Flooding resulting in the destruction of agricultural land would have little to no impact related to the cancellation of Williamson Act contracts. However, in the event of simultaneous levee failures in more than 1 location, adverse effects would be more widespread. Flooding of agricultural areas would likely destroy or damage agricultural outbuildings and residences, leading to reduction in agricultural

productivity; depression of the agricultural economy; and conversion of existing agricultural land to other uses as agricultural landowners sell their land out of choice or necessity.

Lands outside of Stockton's city limits are under the jurisdiction of San Joaquin County, which designates these lands as agricultural. Any growth beyond existing development would result in impacts on Prime Farmland; however, Stockton and San Joaquin County implement numerous measures to limit the effects of growth on farmland conversion and on the daily operation of farmland. If a flood event occurs, Prime Farmland could be affected as the flood debris, sediment and waste could result in the land being less productive for farming. It could take many years to clear the lands and return them to production.

The magnitude of the impact of flooding resulting from levee failure would depend on the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore identification of potential effects is **too speculative for meaningful consideration**.

5.14.3 ALTERNATIVE 7A

It is anticipated that several staging areas, stockpile areas and temporary access haul roads would be developed on agricultural, vacant or undeveloped lands in during project construction. The majority of these lands would be returned to their original use following the completion of construction. Alternative 7a would include the conversion of 1 acre of farmland along the Calaveras River. The removal of 1 acre of farmland within the study area would be less than significant because of the abundance of farmland that would remain in the study area. Additionally, the removal of 1 acres of farmland to construct the project would be significantly less than the effects that could occur during a flood event. This land represents only a small fraction of the total agricultural lands within San Joaquin County.

Some residential and commercial properties adjacent to existing levees would be permanently converted to flood easements or FRM structures. Several of the levee improvements proposed would require land acquisition and may require removal of residences to accommodate the expanded footprint of the levee system. Permanent land acquisition may be necessary for implementation of adjacent levee improvements, relief wells, seepage and stability berms and setback levees. This would occur in most areas of construction along the entire project. Where residential and commercial property back up to construction areas, a swath of land at the back of the properties could be converted to FRM structures. This is primarily the case when properties are extremely close to the existing levee and sometimes within the levee footprint. In many cases, this includes the back yards, pools, out-buildings and landscapes of residents. Based on preliminary design and the maximum footprint, land conversion of residential and commercial property would occur along the entire length of Mosher Slough south levee, Shima Tract, Tenmile Slough, Lower Calaveras River, French Camp Slough and a small area along the SJR.

In addition, sufficient land will need to be acquired to establish an appropriate maintenance corridor at the landside toes of all improved levees. Specific project requirements for right-of-way to construct the project would be determined at the final design phase prior to construction. Permanent acquisition, relocation and compensation services would be conducted in compliance with Federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants and that residents be relocated to comparable replacement housing.

Much of the study area was remapped by FEMA in October 2009, with floodplain designations of X (Levee), A, AE, AH and AO. Because the majority of the study area is currently designated Zone X, there are no development restrictions from a Federal perspective. The communities face potential development restrictions under California Senate Bill 5, which requires provision of 200-year (1/200 ACE) protection

for urban and urbanizing areas with population greater than 10,000. However, the majority of the Alternative 7a study area is built out and not likely to see any increase in floodplain development as a result of the proposed levee improvements.

The changes in land use from the implementation of Alternative 7a do not conflict with land use plans, policies or regulations and would not conflict with master plans, policies or regulations because, overall, affecting the 156 acres of land is small compared to the city and county. Effects for the majority of these acres would be **less than significant** because the project would comply with associated land acquisition and relocation regulations. However, because Alternative 7a would result in direct and indirect effects resulting in the permanent loss of SRA, the project would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.4 ALTERNATIVE 7B

Impacts to land use for Alternative 7b include all impacts discussed for Alternative 7a, with the addition of any land use impacts associated with the proposed levee improvements in RD 17. Within RD 17, there are 12,800 acres that are still in agricultural production, of which 5,300 acres are slated for urban development by the Stockton, Manteca and Lathrop General Plans. These plans are currently under revision and it is likely that the acreage may be reduced. Improving the levees in RD 17 to meet the State's Urban Levee Design Criteria would remove constraints to future development in this area. This would be a significant effect on land use for Alternative 7b and no mitigation would be possible if this alternative were to be implemented.

This alternative would result in the permanent conversion of 30 acres of farmland to flood control easements in several areas of the project. Along the SJR south of the Weston Ranch development, there are a variety of crops orchards and associated irrigation channels that would be impacted by the project. The construction footprint runs along the perimeter of land currently being farmed and would reduce the area of production, but would not divide the farm. The San Joaquin Tie Back Levee would require the acquisition of a 130-foot wide and 2-mile long stretch of land separating some farms into small fragments. Because the project area is abundant with farmland, this would represent 0.2 percent of the overall existing farmland in the area or 0.4 percent of the farmland currently not proposed for redevelopment. Due to the low percentage of farmland affected by the proposed alternative, the effects are considered **less than significant** with the implementation of mitigation. Permanent acquisition, relocation and compensation services would be conducted in compliance with Federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants and that residents be relocated to comparable replacement housing.

The changes in land use from the implementation of Alternative 7b do not conflict with land use plans, policies or regulations. Land use changes do not conflict with master plans, policies or regulations, because overall the 366 acres of land being converted is small compared to the city and county. Effects for the majority of these acres would be **less than significant** because Alternative 7b would comply with associated land acquisition and relocation regulations. However, because Alternative 7b would result in direct and indirect effects from the permanent loss of SRA habitat, Alternative 7b would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.5 ALTERNATIVE 8A

Impacts to land use for Alternative 8a would include all impacts discussed for Alternative 7a, with the addition of any land use impacts associated with the additional levee improvements proposed under this alternative on the Calaveras River and Stockton Diverting Canal. Based on preliminary design and the maximum footprint, land conversion of residential and commercial property would be greater than described in Alternative 7a and much less than those described in 7b because no construction would occur in RD 17.

Alternative 8a would include the conversion of 2 acres of farmland along the Calaveras River. There are some large orchards that would have a small area (about one to two rows of trees) removed to construct the project in this reach. The removal of 2 acres of farmland within the study area would be **less than significant**, because of the abundance of farmland that would remain. Additionally, the removal of 2 acres of farmland to construct the project would be significantly less than the effects that could occur during a flood event.

Similar to Alternative 7a, there could be land acquisition under Alternative 8a along the Stockton Diverting Canal and Calaveras River that may require removal of residences or commercial facilities to accommodate the expanded footprint of the levee system. Permanent land acquisition may be necessary for implementation of adjacent levee improvements. In addition, sufficient land will need to be acquired to establish an appropriate maintenance corridor at the landside toes of all improved levees. Permanent acquisition, relocation and compensation services would be conducted in compliance with Federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants and that residents be relocated to comparable replacement housing.

The changes in land use from the implementation of Alternative 8a do not conflict with land use plans, policies or regulations. Land use changes would not conflict with master plans, policies or regulations because overall the 219 acres of land being impacted is small compared to the city and county. Effects for the majority of these acres would be **less than significant** because the project would comply with associated land acquisition and relocation regulations. However, because Alternative 8a would result in direct and indirect effects from the permanent loss of SRA, the project would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.6 ALTERNATIVE 8B

Impacts to land use for Alternative 8b include all impacts discussed above for Alternative 7b, with the addition of the additional land use impacts associated with the levee improvements proposed on the Calaveras River and Stockton Diverting Canal.

Alternative 8b would include the conversion of 2 acres of farmland along the Calaveras River. There are some large orchards that would have a small area (about one to two rows of trees) removed to construct the project in this reach. The removal of 2 acres of farmland within the study area would be **less than significant** because of the abundance of farmland that would remain. The removal of 2 acres of farmland to construct the project would be significantly less than the effects that could occur during a flood event.

Similar to Alternative 8a, there could be land acquisition under Alternative 8b along the Stockton Diverting Canal and Calaveras River that may require removal of residences or commercial facilities to accommodate the expanded footprint of the levee system. Permanent land acquisition may be necessary for

implementation of adjacent levee improvements. In addition, sufficient land will need to be acquired to establish an appropriate maintenance corridor at the landside toes of all improved levees. Permanent acquisition, relocation and compensation services would be conducted in compliance with Federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants and that residents be relocated to comparable replacement housing.

The changes in land use from the implementation of Alternative 8b do not conflict with land use plans, policies or regulations. Land use changes would not conflict with master plans, policies or regulations because overall the 428 acres of land being impacted is small compared to the city and county. Effects for the majority of these acres would be **less than significant** because the project would comply with associated land acquisition and relocation regulations. However, because Alternative 8b would result in direct and indirect effects from the permanent loss of SRA, the project would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.7 ALTERNATIVE 9A

Impacts to land use for Alternative 9a would include all impacts discussed for Alternative 7a, with the addition of any land use impacts associated with the Mormon Channel flood bypass. The Old Mormon Slough area is currently a dry channel with scattered trees that would be restored to allow a flow of 1,200 cfs during flood events. This flow would not require the construction of levees. Road crossing along Old Mormon Slough are in Section 5.15. Approximately 1 acre of farmland would be converted to permanent flood control use for the construction of the Mormon Channel control structure.

The land in Old Mormon Slough is zoned primarily as general industrial lands, with some parcels zoned for the Port's usage. Most of the land along Old Mormon Slough is vacant, with the exception of a few road crossings. This area attracts public dumping and waste disposal as there is no restricted access. The restoration of the channel would improve the current conditions and could restore some habitat that has deteriorated over the years since the Stockton Diversion Channel was constructed. This would be a **beneficial impact** on land use, since illegal dumping could decrease and habitat could establish.

The changes in land use from the implementation of Alternative 9a do not conflict with land use plans, policies or regulations. Land use changes would not conflict with master plans, policies or regulations because overall the 189 acres of land being impacted is small compared to the city and county and effects for the majority of these acres would be **less than significant** because the project would comply with associated land acquisition and relocation regulations. However, because the Alternative 9a would result in direct and indirect effects from the permanent loss of SRA, the project would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.8 ALTERNATIVE 9B

Impacts to land use for Alternative 9b include all impacts discussed above for Alternative 7b, with the addition of the land use impacts associated with the Old Mormon Channel flood bypass. Approximately 31 acres of farmland would be converted to flood control uses under this alternative, including 30 acres as detailed under Alternative 7b and an additional 1 acre associated with the construction of the Old Mormon Channel control structure. Because the project area is abundant with farmland, this would represent 0.2

percent of the overall existing farmland in the area or 0.4 percent of the farmland currently not proposed for redevelopment. Due to the low percentage of farmland affected by the proposed alternative, the effects are considered **less than significant with the implementation of mitigation**. Permanent acquisition, relocation and compensation services would be conducted in compliance with Federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants and that residents be relocated to comparable replacement housing.

The changes in land use from the implementation of Alternative 9b do not conflict with land use plans, policies or regulations. Land use changes would not conflict with master plans, policies or regulations because overall the 401 acres of land being impacted is small compared to the city and county and effects for the majority of these acres would be **less than significant**, because the project would comply with associated land acquisition and relocation regulations. However, because Alternative 9b would result in direct and indirect effects from the permanent loss of SRA, the project would conflict with the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, resulting in **significant and unavoidable** impacts. The socioeconomic effects of displacement of residents and commercial facilities are in Section 5.13.

5.14.9 MITIGATION

Property acquisition would be consistent will all applicable laws and regulations. If relocation of people, homes or businesses would be minimized to the extent feasible and consistent with the project purpose and compensated under the Federal Relocation Act. In addition, implementation of compensatory habitat mitigation would off-set impacts on sensitive species, other fish and wildlife and their habitats. This would this would be consistent with the overall purpose of the Multispecies Habitat Conservation and Open Space Plan. While these mitigation measures would reduce impacts, they would remain significant and unavoidable because of direct and indirect effects of the permanent loss of SRA and conflict with the Multispecies Habitat Conservation and Open Space Plan.

5.15 TRANSPORTATION

This section describes the affected environment and environmental consequences related to transportation for the LSJR project and the significance of the impacts and mitigation measures to reduce impacts.

5.15.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to transportation are listed below and summarized in Chapter 7.

Federal

- Title 23 of the Code of Federal Regulations (CFR)
- Title 23 of the U.S. Code (USC)

State

- California Streets and Highways Code

Local

- Congestion Management Program (CMP) (CA Government Code, Section 65089)
- City of Lathrop General Plan (2004)
- City of Stockton General Plan (2007)
- San Joaquin County General Plan (2007)
- City of Manteca General Plan 2023 (2013)
- 2014 Regional Transportation Plan and Sustainable Communities Strategy, (adopted by SJCOG June 26, 2014)

Existing Conditions

Flow of traffic and safety conditions are typically categorized according to Level of Service (LOS) on a scale from A to F. A roadway categorized as LOS A supports free-flow operations where traffic flows at or above posted speed limits and all motorists have complete mobility between lanes. A roadway categorized as LOS F represents a breakdown in vehicular flow where every vehicle moves in response to the vehicle in front of it and frequent slowing and stopping are required. A roadway functioning at LOS C represents conditions with free-flow operations and few restrictions. Planners typically establish a threshold of LOS C to provide the most efficient flow of traffic without affecting driver comfort and safety. The roadways below are those within the project area which cross the SJR and tributaries via either low water crossing or bridges and may be impacted by the project (Figure 5-18).

SJCOG is the Congestion Management Agency for San Joaquin County. It adopted its first Congestion Management Program (CMP) in November 1991. SJCOG implements the Congestion Management Program and the Federal Congestion Management Process. The update to the current CMP was adopted by the SJCOG Board of Directors in October 2012 (SJCOG, 2014:2-3).

State-Maintained Highways

One Interstate Highway, I-5 and four state highways, Highway 99, Highway 4, Highway 26 and Highway 88, cross San Joaquin County near the study area. All of these roads are regionally significant and are included in the Congestion Management Program for San Joaquin County.

Figure 5-18: Transportation Routes

I-5 and Highway 99

I-5 traverses Washington, Oregon and California from north to south, connecting Vancouver, Canada to Tijuana, Mexico and is an important corridor for both commuter and freight traffic. As I-5 enters the Central Valley from the south, Highway 99 splits from it and travels through the Central Valley East of the SJR and services the larger population centers of the valley, including Bakersfield and Fresno. I-5 skirts the more remote western extremity of the valley and crosses the Calaveras River and Old Mormon Slough in Stockton and the SJR in RD 17. Highway 99 crosses the Stockton Diverting Canal and Mormon Channel. In Central Stockton at the interchange with Highway 4, I-5 has an Annual Average Daily Traffic (AADT) of 139,000. In RD 17 at Lathrop Road, I-5 has an AADT of 98,000. In Central Stockton at Hammer Lane, Highway 99 has an AADT of 64,000. In RD 17 at the junction of Highway 120, Highway 99 has an AADT of 66,000 (Caltrans, 2012).

Highway 4

Highway 4 runs east-west and connects I-5 to Highway 99 north of the Old Mormon Slough. The existing LOS varies from C to D, according to the Stockton General Plan (City of Stockton, 2007a), with an AADT of 15,400 to 96,000 (Caltrans, 2012).

State Route 88/Waterloo Road

Waterloo Road is a four lane road which runs generally northeast and is locally and Federally-classified as a minor arterial road. It originates at Wilson Way and crosses the Stockton Diverting Canal before it becomes State Route 88. The AADT for Highway 88 at its junction with Highway 99 is 24,100 (Caltrans, 2012).

State Route 26/Fremont St.

Fremont Street is a four lane road which connects I-5 to Highway 99. As it exits Stockton, Fremont Street becomes Highway 26 and crosses the Stockton Diverting Canal. Highway 26 roughly parallels Highway 88 as it extends onward through agricultural areas and communities to the northeast. The AADT for Highway 26 at its junction with Highway 99 is 15,500 (Caltrans, 2012).

State Route 120

This road generally runs east and west, connecting the valley with the Sierra Nevada Mountains. State Route 120 originates as a freeway that intersects I-5 and extends I-205 through Manteca. In east Manteca, this freeway ends at SR 99 and becomes a highway that continues east through agricultural lands, the foothills of the Sierra Nevada and Yosemite National Park, ending at U.S. Route 6 in Mono County.

City- and County-Managed Roadways

The different types of roadways in the project area include arterials, collectors and local roads. Arterials provide access to shopping, employment and recreation and comprise the main network for traffic within and between communities. Collectors are the main interior streets carrying traffic from neighborhoods and business areas to higher level roads. Local facilities are two lane streets providing local access and service in agricultural and rural areas of the county. Roads which cross the SJR and tributaries in the LSJRFS study area are briefly described.

- 6 vehicle bridges, which are two-lane minor arterial roadways, cross the Stockton Diverting Canal: Cherokee Road, Main Street, Highway 26, Wilson Way, Highway 88, Highway 99.
- 6 vehicle bridges cross the Calaveras River: West Lane (4-lane, minor arterial), El Dorado Street, Pacific Avenue, Pershing Avenue and I-5. Between Pacific Avenue and Pershing Avenue, a footbridge provides pedestrian access across the river into University of the Pacific. A second footbridge is located east of West Lane just west of the Union Pacific Railroad's Fresno subdivision.
- Five vehicle bridges cross Mosher Slough: Mariners Drive, Interstate 5, Kelley Drive, Don Avenue and Thornton Road. A footbridge provided pedestrian access across the slough between Yarmouth Drive and Bainbridge Place.
- 4 vehicle bridges cross the SJR: Howard Road (minor arterial), Charter Way, Highway 4 and I-5.
- One pedestrian bridge and 22 vehicle bridges and low-water crossings cross Old Mormon Slough, including vehicle bridges for Interstate 5 and Highway 4.
- A 2-lane vehicle bridge crosses Fourteenmile Slough at Feather River Drive.
- 2 vehicle bridges cross French Camp Slough: Carolyn Weston and Manthey Road.

Haul routes have not yet been designated but would be analyzed in subsequent CEQA and NEPA environmental documentation. The project area would be accessed from I-5, Highway 99 and major arterial roadways, which would connect to minor arterial, local and connector roadways to access study areas. Access to levees would be provided from residential streets and rural agricultural roads which connect to maintenance ramps. In addition, public access to the levee and river would be provided at Buckley Cove Boat Launch, on the SJR north of the Calaveras, Louis Park Boat Launch at the confluence of Smith Canal and Dos Reis Regional Park on the SJR north of Old River.

Public Transit

San Joaquin Regional Transit District provides fixed route service throughout the Stockton Metropolitan Area and provides subscription commuter services connecting Stockton with Livermore, Dublin, Mountain View, Palo Alto, Pleasanton, Santa Clara, Sunnyvale, San Jose and Sacramento.

Railroad

Stockton is served by two national rail lines (the Union Pacific Railroad [UPRR] and the Burlington Northern Santa Fe Railroad [BNSF]) and two short line railroads (Central California Traction Company [CCT] and Stockton Terminal and Eastern Railroad [STE]). UPRR owns 2,773 track miles in California. BNSF owns 1,155 track miles and operates more than 2,000 track miles in California. STE operates freight service in Stockton along 25 miles of leased UPRR rail lines (UPRR, 2013) and CCT operates freight service along 16 miles of track between Stockton and Lodi (UPRR, 2013). Commodities carried include agriculture, asphalt, cement, food processing, lumber, steel and chemical transportation.

The Altamont Commuter Express provides passenger service between Stockton and San Jose. Service currently consists of four westbound morning trains and four eastbound evening trains. Amtrak also makes stops in Stockton and provides passenger service to the rest of the nation.

5.15.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature review and accepted standards of professional practice.

Basis of Significance

A project alternative would have a significant impact on traffic or transportation if it would:

- Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system;
- Conflict with an applicable congestion management plans (CMP), including, but not limited to, LOS standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways;
- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;
- Substantially increase hazards due to a design feature (such as sharp curves or dangerous intersections) or incompatible uses (such as farm equipment);
- Result in inadequate emergency access;
- Result in inadequate parking capacity; or
- Conflict with adopted policies, plans or programs supporting public transit, bicycle or pedestrian facilities or otherwise decrease the performance or safety of such facilities.

To account for the large percentage of heavy trucks associated with typical construction projects, the Institute of Transportation Engineers recommends a threshold level of 50 or more new peak-direction trips during the peak hours. Therefore, an alternative would cause an increase in traffic that is substantial in relation to the existing traffic load and capacity and result in a significant impact related to traffic, if it would result in 50 or more new truck trips during the morning or evening peak hours.

Effects and Mitigation Measures

None of the project alternatives would involve local transportation land use changes as a result of flood management improvements. Project construction under all alternatives would not increase air traffic levels or introduce new safety risks related to aviation. Therefore, hazards related to design features, parking capacity, land use or air traffic are not discussed in further detail.

The Stockton General Plan denotes several proposed and existing bicycle routes within the project area. These bicycle paths would either cross over the proposed levee improvements or could be built on the levees. Levee improvement would not preclude development of these alternative transportation routes and there would be no impact. Therefore, alternative transportation routes are not discussed in further detail.

5.15.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, construction of the project would not occur. However, if a flood occurs, there would be a substantial increase in traffic due to debris removal and clean-up. Additionally, roads could be covered with sediment and debris, making emergency access difficult. Bridges and railroads could also be damaged during a flood event, making access to areas impossible. This would be a **significant and unavoidable** impact on transportation because of the increase in traffic during clean-up and the inadequate emergency access during and immediately following a flood event.

5.15.4 ALTERNATIVE 7A

The SJCOG CMP is the applicable CMP for Alternative 7a. The CMP emphasizes travel demand measures to reduce the number of miles driven per capita; infrastructure improvements to reduce SOV trips; land use regulations to encourage the use of alternative modes of transportation instead of cars; and monitoring and enforcement of travel demand measure implementation by development projects. Homes, businesses and other traffic generating development will not be constructed under Alternative 7a. Because construction related traffic is not targeted in the CMP to reduce congestion, no conflict with the CMP would occur with implementation of Alternative 7a.

Alternative 7a would result in minimal, short term impacts on traffic but would not substantially restrict emergency access. Because homes, businesses and other traffic-generating development would not be constructed under Alternative 7a and because construction related traffic is not targeted in the CMP, Alternative 7a would not conflict with the SJCOG CMP.

The construction impacts would be the smallest of all action alternatives. Flood risk would be reduced to existing urban development. During the peak of construction, a maximum of 327 haul trips per day would be required to transport the construction materials to the site and a maximum crew of 60 workers would commute to the site each day during peak hours. Traffic would increase on local roadways associated with construction trips. In addition, temporary lane closures associated with levee improvements and with construction staging and laydown areas could cause or contribute to temporary increases in traffic levels as traffic slows down on local, collector and arterial streets. Increased traffic congestion on road segments and intersections would temporarily interfere with the use of main roadways for emergency evacuation routes. After construction of Alternative 7a is complete, however, the risk of inundation to freeway onramps and off-ramps would be reduced, which would improve access for emergency responders and reduce delays of local and regional residents returning to residences after floods.

For some sites, truck trips may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the project area. When possible, construction schedules would avoid routes that impact schools during the school year.

However, the project would impact routes to schools even with mitigation and impacts to schools would be **significant and unavoidable**.

The proposed levee repairs under Alternative 7a would cross 2 railroad bridges. Freight and passenger service could be disrupted for a day or more if necessary to complete cutoff wall construction beneath these bridges. In some cases, levee height fixes are proposed as well, which may require modifications to the existing railway over the levee, but the extent of these modifications is not known at this time. Detailed designs of railway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the railways would be reconstructed in their current alignment.

In addition, the proposed levee repairs under Alternative 7a would cross 27 roadway bridges. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require modifications to the existing roadway. However, the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the roadways would reconstructed in their current alignment.

Because implementation of Alternative 7a could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling materials through residential neighborhoods and school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.5 ALTERNATIVE 7B

The SJCOG CMP is the applicable CMP for Alternative 7b. Homes, businesses and other traffic generating development will not be constructed under Alternative 7b. Because construction related traffic is not targeted in the CMP to reduce congestion, no conflict with the CMP would occur with implementation of Alternative 7b. Alternative 7b would result in minimal, short-term impacts on traffic but would not substantially restrict emergency access. Because homes, businesses and other traffic-generating development would not be constructed and because construction related traffic is not targeted in the CMP, Alternative 7b would not conflict with the SJCOG CMP.

Assuming a peak crew size of 60 workers, 60 additional commuter trips would be added during peak hours. In addition, activities would require moving large quantities of soil, construction materials and heavy equipment into and out of the study area. During the peak of construction, the number of daily round trips to haul materials would be 327. This volume is less than 10 percent of the total anticipated daily volume for any given road in the project area. Assuming a 10-hour workday, implementation of Alternative 7b would add 33 truck trips during the peak-hour period. This number is well below the significance threshold of 50 new truck trips per hour. However, roadways with a LOS of D or F may still experience a significant effect from this increase in truck traffic. It is possible that haul trucks could be distributed over several haul routes within the project area due to simultaneous construction of levee elements at different locations, reducing the number of truck trips per street.

Alternative 7b would increase traffic on local roadways associated with construction trips. In addition, temporary lane closures associated with levee improvements could cause or contribute to temporary increases in traffic levels on some local, collector and arterial streets. Increased traffic congestion on road segments and intersections could temporarily interfere with the use of main roadways for emergency evacuation routes. After construction of Alternative 7b is complete, however, the risk of inundation to freeway onramps and off-ramps would be reduced, which could improve access for emergency responders and prevent delays of local and regional residents returning to residences after floods. Construction related

impacts from Alternative 7b could potentially result in a significant effect on the effectiveness and performance of local circulation systems.

For some sites, truck trips may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the project area. When possible, construction schedules would avoid routes that impact schools during the school year. However, the project would impact routes to schools even with mitigation and impacts to schools would be **significant and unavoidable**.

The proposed levee repairs would cross 5 railroad bridges. Freight and passenger service could be disrupted for a day or more if necessary to complete cutoff wall construction beneath these bridges. These effects would be temporary; the alignment of the railroads would not be affected by the proposed repairs, nor would any railroads need to be permanently raised.

In addition, the proposed levee repairs under Alternative 7b would cross 35 roadway bridges and one pedestrian bridge. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require modifications to the existing roadway. However, the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the roadways would reconstructed in their current alignment.

Because implementation of Alternative 7b could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling materials through residential areas and school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.6 ALTERNATIVE 8A

Impacts from implementation of Alternative 8a would be similar to Alternative 7a except that it would result in additional construction on Lower Calaveras River levees and on the Stockton Diverting Canal. Affects to transportation would be the same during peak hours as for Alternative 7a, but the duration of construction would be increased because of the larger construction footprint. During the peak of construction, each day a maximum of 327 haul trips would be required to transport the construction materials to the site and a maximum crew of 60 workers would commute to the site during peak hours. This is well below the significance threshold of 50 new truck trips per hour. However, roadways with a LOS of D or F may still experience a significant effect from this increase in truck traffic. It is possible that haul trucks could be distributed over several haul routes within the project area due to simultaneous construction of levee elements at different locations, reducing the number of truck trips per street.

Alternative 8a would increase traffic on local roadways associated with construction trips. In addition, temporary lane closures associated with levee improvements and with construction staging and laydown could cause or contribute to temporary increases in traffic levels as traffic slows down on some local, collector and arterial streets. Increased traffic congestion on road segments and intersections could temporarily interfere with the use of main roadways for emergency evacuation routes. After construction of Alternative 8a is complete, however, the risk of inundation to freeway onramps and off-ramps would be reduced, which could improve access for emergency responders and prevent delays of local and regional residents returning to residences after floods.

For some sites, truck trips may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the project area. When possible, construction schedules would avoid routes that impact schools during the school year.

However, the project would impact routes to schools even with mitigation and impacts to schools would be **significant and unavoidable**.

The proposed levee repairs under Alternative 8a would cross 6 railroad bridges. Freight and passenger service could be disrupted for a day or more if necessary to complete cutoff wall construction beneath these bridges. In some cases, levee height fixes are proposed as well, which might require modifications to the existing railway over the levee, but the extent of these modifications is not known at this time. Detailed designs of railway crossings would be completed in PED phase. Effects associated with service disruption would be temporary and the railways would be reconstructed in their current alignment.

In addition, the proposed levee repairs under Alternative 8a would cross 39 roadway bridges. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require modifications to the existing roadway. However, the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the roadways would be reconstructed in their current alignment.

Because implementation of Alternative 8a could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling through residential areas and school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.7 ALTERNATIVE 8B

The SJCOG CMP is the applicable CMP for Alternative 8b. Homes, businesses and other traffic generating development will not be constructed under Alternative 8b. Because construction related traffic is not targeted in the CMP to reduce congestion, no conflict with the CMP would occur with implementation of Alternative 8b.

Alternative 8b would result in minimal, short-term impacts on traffic, but would not substantially restrict emergency access. Because homes, businesses, and other traffic-generating development would not be constructed under Alternative 8b, and because construction related traffic is not targeted in the CMP, Alternative 8b would not conflict with the SJCOG CMP. Assuming a peak crew size of 60 workers, 60 additional commuter trips would be added during peak hours. In addition, activities would require moving large quantities of soil, construction materials and heavy equipment into and out of the study area. During the peak of construction, the number of daily round trips to haul materials would be 327. This volume is less than 10 percent of the total anticipated daily volume for any given road in the project area. Assuming a 10-hour workday, implementation of Alternative 8b would add 33 truck trips during the peak-hour period. This number is well below the significance threshold of 50 new truck trips per hour. However, roadways with a LOS of D or F may still experience a significant effect from this increase in truck traffic. It is possible that haul trucks could be distributed over several haul routes within the project area due to simultaneous construction of levee elements at different locations, reducing the number of truck trips per street.

Alternative 8b would increase traffic on local roadways associated with construction trips. In addition, temporary lane closures associated with levee improvements and with construction staging and laydown could cause or contribute to temporary increases in traffic levels as traffic slows down on some local, collector and arterial streets. Increased traffic congestion on road segments and intersections could temporarily interfere with the use of main roadways for emergency evacuation routes. After construction of Alternative 8b is complete, however, the risk of inundation to freeway onramps and off-ramps would be reduced, which could improve access for emergency responders and prevent delays of local and regional residents returning to residences after floods.

For some sites, truck trips may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the project area. When possible, construction schedules would avoid routes that impact schools during the school year. However, the project would impact routes to schools even with mitigation and impacts to schools would be **significant and unavoidable**.

The proposed levee repairs under Alternative 8b would cross 8 railroad bridges. Freight and passenger service could be disrupted for a day or more if necessary to complete cutoff wall construction beneath these bridges. In some cases, levee height fixes are proposed as well, which might require modifications to the existing railway over the levee, but the extent of these modifications is not known at this time. Detailed designs of railway crossings would be completed in PED phase. Effects associated with service disruption would be temporary and the railways would reconstructed in their current alignment.

In addition, the proposed levee repairs under Alternative 8b would cross 47 roadway bridges. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require modifications to the existing roadway. However, the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the roadways would be reconstructed in their current alignment.

Because implementation of Alternative 8b could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling through residential areas and school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.8 ALTERNATIVE 9A

Under Alternative 9a, the project footprint and proposed activities would be the same as Alternative 7a, with the addition of a flood bypass proposed in Old Mormon Slough. In addition to the impacts described in Alternative 7a, the channel improvements proposed in Alternative 9a would require the removal of 4 channel crossings and replacement with bridges along the Old Mormon Slough alignment, including Commerce Street, Stanislaus Street, David Avenue and Gillis Road. Low water crossings for Bieghle Alley and Pilgrim Street would be incorporated into the channel area and no bridge installed. However, these are unpaved dirt access roads created by use and not part of the public road system. Detours would be required on each bridge crossing for several weeks during levee construction. Detour routes and lane closures would be minimized to the extent possible.

There are four railroad crossings on Old Mormon Slough, in addition to the two railroad bridges on the SJR affected by cutoff wall construction. In one of the Old Mormon Slough crossings, two additional culverts would be installed to supplement the four existing 8-foot culverts. Freight and passenger service could be disrupted for a day or more if necessary to complete culvert construction beneath this railroad crossing. These effects would be temporary; the alignment of the railroads would not be affected by the proposed repairs, nor would the railroads need to be permanently raised.

Freight and passenger service could be disrupted for a day or more if necessary to complete cutoff wall construction beneath the two railroad bridges on the SJR. In some cases, levee height fixes are proposed as well, which might require modifications to the existing railway over the levee. However, the extent of these modifications is not known at this time. Detailed designs of railway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the railways would be reconstructed in their current alignment.

In addition, the proposed levee repairs under Alternative 9a would cross 27 roadway bridges. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require modifications to the existing roadway. However, the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the roadways would be reconstructed in their current alignment.

Because implementation of Alternative 9a could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling of materials through residential neighborhoods and school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.9 ALTERNATIVE 9B

Under Alternative 9b, the project footprint and proposed activities would be the same as Alternative 7b, with the exception that a bypass would be constructed in Old Mormon Slough. Assuming a peak crew size of 60 workers, 60 additional commuter trips would be added during peak hours. In addition, activities would require moving large quantities of soil, construction materials and heavy equipment into and out of the study area. During the peak of construction, the number of daily round trips to haul materials would be 327. This volume is less than 10 percent of the total anticipated daily volume for any given road in the project area. Assuming a 10-hour workday, implementation of Alternative 9b would add 33 truck trips during the peak-hour period. This number is well below the significance threshold of 50 new truck trips per hour. However, roadways with a LOS of D or F may still experience a significant effect from this increase in truck traffic. It is possible that haul trucks could be distributed over several haul routes within the project area due to simultaneous construction of levee elements at different locations, reducing the number of truck trips per street.

Alternative 9b would increase traffic on local roadways associated with construction trips. In addition, temporary lane closures associated with levee improvements could cause or contribute to temporary increases in traffic levels on some local, collector and arterial streets. Increased traffic congestion on road segments and intersections could temporarily interfere with the use of main roadways for emergency evacuation routes. After construction of Alternative 9b is complete, however, the risk of inundation to freeway onramps and off-ramps would be reduced, which could improve access for emergency responders and prevent delays of local and regional residents returning to residences after floods. Construction related impacts from Alternative 9b could potentially result in a significant effect on the effectiveness and performance of local circulation systems.

For some sites, truck trips may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the project area. When possible, construction schedules would avoid routes that impact schools during the school year. However, the project would impact routes to schools even with mitigation and impacts to schools would be **significant and unavoidable**.

In addition to the impacts described in Alternative 7b, the channel improvements proposed in Alternative 9b would require the removal of 4 channel crossings and replacement with bridges along the Mormon Channel alignment, including Commerce Street, Stanislaus Street, David Avenue and Gillis Road. Low water crossings for Bieghle Alley and Pilgrim Street would be incorporated into the channel area and no bridge installed. However, these are unpaved dirt access roads created by use and not part of the public road system. Detours would be required on each bridge crossing for several weeks during levee construction. Detour routes and lane closures would be minimized to the extent possible.

There are four railroad crossings on Old Mormon Slough, in addition to the five railroad bridges on the SJR affected by cutoff wall construction. In one of the Mormon Channel crossings, two additional culverts would be installed to supplement the four existing 8-foot culverts. Freight and passenger service could be disrupted for a day or more, if necessary, to complete culvert construction beneath this railroad crossing. These effects would be temporary; the alignment of the railroads would not be affected by the proposed repairs, nor would the railroads need to be permanently raised.

Freight and passenger service could be disrupted for a day or more, if necessary, to complete cutoff wall construction beneath the five railroad bridges on the SJR. In some cases, levee height fixes are proposed as well, which might require modifications to the existing railway over the levee. However, the extent of these modifications is not known at this time. Detailed designs of railway crossings would be completed in the design phase of the project. Effects associated with service disruption would be temporary and the railways would be reconstructed in their current alignment.

In addition, the proposed levee repairs under Alternative 9b would cross 35 roadway bridges and 1 pedestrian bridge. Construction of slurry walls could require drilling through the roadway, which would require road or lane closures and temporary disruptions of service. In some locations, there may be a levee height fix required at the roadway crossings. Levee height fixes may require existing roadway modifications, but the extent of these modifications is not known at this time. Detailed designs of roadway crossings would be completed in PED phase. Effects associated with service disruption would be temporary and the roadways would be reconstructed in their current alignment.

Because implementation of Alternative 9b could result in temporary delays in emergency response time, temporary railroad service disruptions, hauling materials through residential areas and in school zones and potential interference with evacuation routes during construction, this impact would be **significant and unavoidable**.

5.15.10 MITIGATION

Alternative 7a and 7b mitigation proposes that during preliminary engineering and design, the project proponents (USACE, DWR and SJAFCA) shall provide notification of project construction to all appropriate railroads in the project area and shall coordinate with all railroads to minimize freight and passenger service disruptions. Notification of project construction with all appropriate railroads in the project area is to minimize freight and passenger service disruptions that would occur.

Before the start of each construction season, the primary contractors for engineering and construction shall develop a coordinated construction traffic safety and control plan to minimize the simultaneous use of roadways by different construction contractors for material hauling and equipment delivery to the extent feasible and to avoid and minimize potential traffic hazards on local roadways during construction. Items (a) through (f) of this mitigation measure shall be integrated as terms of the construction contracts.

a) The plan shall outline phasing of activities and the use of multiple routes to and from off site locations to minimize the daily amount of traffic on individual roadways.

b) The construction contractors shall develop traffic safety and control plans for the local roadways that would be affected by construction traffic. Before the initiation of construction-related activity involving high volumes of traffic, the plan shall be submitted for review by the agency of local jurisdiction (San Joaquin County, City of Stockton or Caltrans [if applicable]) that has responsibility for roadway safety at and between project sites. The contractor would train construction personnel in appropriate safety measures as described in the plan and shall implement the plan. The plan would include the prescribed locations for staging equipment and parking trucks and vehicles. Provisions would be made for overnight parking of haul trucks to avoid causing traffic or circulation congestion. The plan shall call for the following elements:

- posting warnings about the potential presence of slow-moving vehicles;
- using traffic control personnel when appropriate; and
- placing and maintaining barriers and installing traffic control devices necessary for safety, as specified in Caltrans's Manual of Traffic Controls for Construction and Maintenance Work Zones and in accordance with city/county requirements.

c) All operations would limit and expeditiously remove, as necessary, the accumulation of project-generated mud or dirt from adjacent public streets at least once every 24 hours if substantial volumes of soil are carried onto adjacent paved public roadways during construction.

d) If needed to comply with Caltrans requirements, a transportation management plan would be prepared and submitted to Caltrans to cover any points of access from the State highway system for haul trucks and other construction equipment.

e) Before the start of the first construction season, the project proponent would enter into maintenance agreements with San Joaquin County and the City of Stockton to address maintenance and repair of affected roadways resulting from increased truck traffic. The agreements would ensure that the affected roadways are repaired to a level that is equivalent to their pre-project condition.

f) Before project construction begins, the contractor would provide notification of project construction to all appropriate emergency service providers in San Joaquin County, Stockton, Lathrop and Manteca and shall coordinate with providers throughout the construction period to ensure that emergency access through construction areas is maintained.

The contractor would be required to avoid neighborhoods and school zones to the maximum extent feasible when determining haul routes. When possible, hauling in school zones would be limited to the period of summer breaks to avoid noise and traffic impacts to the schools. Any damage to residential roadways during construction would be mitigated per the requirements outlined in the traffic safety and control plan. Alternatives 8a and 8b mitigation measures shall be implemented as described for Alternatives 7a and 7b, except that they would be expanded to include additional lands and the jurisdictions along the Stockton Diverting Canal. During preliminary engineering and design, the project proponent shall provide notification of project construction to all appropriate railroads in the project area, and shall coordinate with all railroads to minimize freight and passenger service disruptions.

Alternatives 9a and 9b mitigation measures shall be implemented as described for Alternative 7a and Alternative 7b, except that they would be expanded to include additional lands and the jurisdictions along the Old Mormon Slough. Prior to construction, USACE would coordinate with Caltrans and the City of Stockton to determine detour routes for all proposed bridge replacements. Public notification would occur prior to all bridge closures during construction.

Implementation of the traffic safety and control plan (outlined in Alternatives 7a and 7b) and coordination with the railroads would reduce the transportation impacts. Because haul routes are unknown at this time, the magnitude of impacts to transportation and circulation during construction activities cannot be quantified; therefore, even with mitigation measures impacts would remain **significant and unavoidable**.

5.16 UTILITIES AND PUBLIC SERVICES

This section describes the affected environment and environmental consequences relating to public utilities and public services for the LSJR project and the significance of the impacts and mitigation measures to reduce impacts.

5.16.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to utilities and public services and use are listed below and summarized in Chapter 7.

State

- California Integrated Waste Management Act
- California Public Utilities Commission

Local

- City of Lathrop General Plan (2004)
- City of Stockton General Plan (2007)
- San Joaquin County General Plan (2007)
- City of Manteca General Plan 2023 (2013)

Existing Conditions

Water Services

San Joaquin County

Water supply in San Joaquin County is provided by surface water and groundwater. Over 50 water agencies provide services to County residents. In addition, hundreds of smaller private water systems and individual wells provide domestic and agricultural uses (San Joaquin County, 2010). The South San Joaquin County Water Supply Program addresses current and future needs of the southern part of the county, including Manteca and Lathrop. The first phase of this program became operational in 2005.

Stockton

Stockton's potable water is provided by a combination of treated surface water from the Delta Water Supply Project and SEWD and pumped groundwater. Surface water from Calaveras River and Stanislaus River has historically provided 60 percent of the water supply in the City of Stockton Metropolitan Area. The total available surface water varies from 104,100 AF/year to 48,000 AF/year. Treatment and distribution capacity at SEWD is 56,000 AF/year (City of Stockton, 2008a).

Groundwater extraction has historically provided 40 percent of Stockton's water supply and ranges from 0.75 to 1.0 AF/year. The long-term operational goal for sustainable groundwater yield is 0.6 AF/year (City

of Stockton 2007, 2008a). Groundwater quality is increasingly affected by salinity levels, pesticides and fertilizers due to continued overdraft in the basin. Although treatment options are still being evaluated, the cost of desalination may necessitate a switch from groundwater to another supply source.

The City of Stockton's water demand as of 2004 was 68,714 AF/year. Water demand is expected to increase to 85,330 AF/year by 2015 and to 156,083 AF/year by 2035. To meet future water supply needs, the city is exploring groundwater storage projects, non-potable water supplies from local communities and raw surface water transfers from local irrigation districts. Groundwater, surface water and other potential water supplies have been considered sufficient to meet current and future annual demands (City of Stockton, 2007). The extended drought currently being experienced in California will likely cause reassessment of water supply, demand and management.

Five new storage tanks are needed to meet the required pressure for existing peak demands and fire flow conditions. The existing well pumping capacity is adequate, but 3 new wells are needed to improve the supply reliability during dry and critical years. The 10-inch diameter pipeline near Swain Road does not meet head loss and velocity requirements; a 12-inch diameter pipeline in parallel with the existing line is needed to meet standards. An 18-inch diameter looped pipeline system is required to improve the peak-hour water pressure in the County Jail and Hospital area (City of Stockton, 2008a). With these improvements, the existing system will provide satisfactory service to Stockton.

Manteca and Lathrop

The Cities of Manteca and Lathrop rely on both surface and groundwater for their domestic water. Surface water became available in 2005 when the Nick C. DeGroot Water Treatment Plant began operation. Manteca uses surface water to supplement groundwater from about April to October, when water use is high. The surface water used by both cities is from the Stanislaus River watershed.

Manteca has contracted to receive up to 11,500 acre feet/year from the South County Surface Water Supply Project, depending upon supplies available from the watershed. A planned expansion of the project would provide up to an additional 18,500 AF/year to Manteca. This would be sufficient surface water to support a doubling of the population to 150,000 residents. Groundwater is provided through a system of interconnected wells operated by the city. The wells range from 155 feet to 400 feet deep. Well capacity ranges from 380 gpm to 2,300 gpm. The city has a 300,000-gallon surface storage tank.

The City of Lathrop will receive up to 8,007 AF/year from the South County Water Supply Program. The City has two one million gallons storage tanks and one 425,000 gallons tank.

Waste Water

San Joaquin County

There are 9 publicly operated collection and treatment systems in the County, each associated with a city or town, including Stockton, Lathrop and Manteca. Some smaller, private treatment plants serve individual developments.

Stockton

The city of Stockton's wastewater is collected and treated by the Regional Wastewater Control Facility (RWCF) and the City of Stockton Wastewater Collection System Facilities. The City of Stockton Wastewater Collection System Facilities is a system of 965,289 feet of pipe and 28 pump stations that collect wastewater throughout the city for discharge to the RWCF or a downstream gravity sewer. RWCF is located north of Highway 4 on both sides of the SJR and provides primary, secondary and tertiary wastewater treatment (City of Stockton, 2007a). Under an NPDES permit, treated water from the RWCF is discharged into the SJR after dechlorination. Zero surface water discharge was considered, but found to be cost-prohibitive; the current plan for recycling is to use treated effluent to offset withdrawals of Delta water for potable use.

Between July 2008 and April 2013, RWCF exceeded final effluent limitations on several contaminants including ammonia, aluminum, cyanide and chlorine disinfection byproducts (CSWRCB, 2013). However, since immediate compliance is not practicable, the facility is following a time schedule order to ensure compliance by October 2013 which has subsequently been extended as improvements are made to the facility. RWCF met all interim effluent limitations outlined in the order (CVRWQCB, 2008) and the facility has increased monitoring, conducted impact studies, improved the disinfection facilities and constructed new nitrifying biotower facilities (City of Stockton, 2008b).

The RWCF has a dry-weather operational capacity of 55 million gallons per day (mgd) and currently processes an average of 33 mgd. Peak wet weather flows are projected to be 179.2 mgd. To meet future water quality permitting requirements and projected flows of 71 mgd average dry weather flow, 24,000 square feet of additional sedimentation basins, expansion of existing pumping and treatment facilities and expansion of secondary and tertiary treatment systems will be required by 2035 (City of Stockton, 2008b).

Manteca and Lathrop

The City of Manteca Wastewater Treatment Plant serves Manteca and Lathrop. It treats about 6.5 mgd of wastewater per day and has a capacity of 9.8 mgd. During the spring and summer, secondary effluent is applied agricultural fields and then discharged to the SJR. Dried sludge is spread on agricultural lands adjacent to the plant site.

The City of Lathrop contracts with Manteca for use of the Manteca Wastewater Treatment Plant. This facility treats wastewater generated in the areas east of Interstate 5 and north of Louise Avenue. All wastewater generated in the areas west of Interstate 5 and south of Louise Avenue is conveyed to the Lathrop Water Recycling Plant. This plant is designed to treat about 0.75 million gallons per day of raw sewage. The recycled water is used for landscape irrigation and farming activities for fodder crops.

Stormwater

The San Joaquin County Public Works Utilities Maintenance office maintains the stormwater system in the county. This system conveys stormwater directly to local waterways. The City of Stockton is responsible for stormwater collection, drainage and disposal and maintains and services all storm drains within the city limits. Primary waters that drain the city include: SJR, Bear Creek, Mosher Slough, Fivemile Slough, Fourteenmile Slough, Calaveras River and Stockton Diverting Canal, Smith Canal and French Camp and Walker Sloughs. Runoff in Lincoln Village west of Fourteenmile Slough is collected in the artificial lakes in the center of the development and pumped into the river when lake levels become too high. In other parts of Stockton, storm runoff is collected in 620 miles of underground pipes and pump stations that have adequate drainage capacity to serve existing and new development.

Municipal NPDES permitting, which involves management plans, treatment and monitoring of stormwater, is required because the City of Stockton qualifies as a large municipality. Stormwater discharges resulted in the classification of several waterways as "water quality impaired." Waterways on the 303(d) list include Lower Calaveras River, Delta Waterways (eastern portion and Stockton Ship Channel), Mormon Slough, Mosher Slough and the SJR. Causes of impairment or threatened impairment include pesticides, heavy metals, pathogens and oxygen demanding substances (CVRWQCB, 2007).

In RD 17, stormwater is commonly collected in agricultural ditches, channels, stormwater sewers and retention ponds. The City of Stockton provides stormwater service to portions of RD 17. The City of Lathrop's storm drainage system collects flows, stores them in detention basins and pumps them into the SJR through a municipal stormwater outfall. Stormwater in Manteca is handled by the city and by the South San Joaquin Irrigation District (City of Manteca, 2003). Drainage flows west into French Camp Canal, which flows into French Camp Slough and ultimately drains into the Delta. Manteca has a target level of service of 10-year storm drainage protection for all development and a 100-year storm drainage protection for all structures (City of Manteca, 2003).

Solid Waste

The County Solid Waste Management Plan governs solid waste management in all County jurisdictions. The San Joaquin County Department of Public Works is responsible for solid waste management in the County. Most waste is municipal waste from residential and commercial/industrial sources. Three landfills serve the county: Foothill Sanitary Landfill, Lovelace Materials Recovery Facility and Transfer Station and North County Recycling Center and Sanitary Landfill.

Allied Waste, California Waste Recovery Systems and Waste Management are the 3 waste management companies that haul waste and provide recycling services for Stockton. About 67 percent of Stockton's waste is diverted through curbside recycling, material recovery and composting. The remaining 33 percent is deposited in the landfill (CalRecycle, 2006). Stockton disposes of 229,000 tons of waste annually, with a per-capita daily disposal rate of 6.9 pounds (CalRecycle, 2011). In 1999, 46 percent of Stockton's waste came from households and 54 percent came from businesses (CalRecycle, 1999).

Three landfills serve the city of Stockton, including Forward Landfill, Foothill Landfill and North County Sanitary Landfill. Foothill Landfill is the primary landfill, receiving an average of 810 tons per day and permitted for 1,500 tons per day. The Foothill Landfill has capacity until 2054 and there are no plans for new landfills or landfill expansion (City of Stockton, 2007).

In Manteca, the Manteca Solid Waste Division collects solid waste and deposits it at the Lovelace Solid Waste Transfer Station. Recyclable materials are sorted at the Lovelace facility. Green waste is delivered to the Austin Road/Forward Landfill, which has a capacity of 1,608,752 cy and a closure date of 2053 (City of Manteca, 2003).

Energy Use and Conservation

Pacific Gas and Electric Company (PG&E) supplies the study area, including Stockton, Manteca and Lathrop, with natural gas and electricity from the company's inter-grid system. San Joaquin County consumes 5244 million kWh/year of electricity and 218 million therms of natural gas. Thirty-three (33) percent of the electricity and 44 percent of natural gas are consumed by residential users (CA Energy Commission, 2011).

Energy conservation efforts aim to appropriately site buildings for optimal sun exposure, implement active and passive solar heating and water systems, shade streets to reduce radiation heating and implement land use and transportation policies that encourage fewer and shorter vehicle trips. Stockton enforces the State (Title) 24 Building Codes on energy efficiency for all new development and also standard conditions for incorporation of solar energy conservation. Additional energy efficiency would be achieved by requiring that all new residential development meet the State Energy Star qualifications. Further, San Joaquin County and the City of Stockton are encouraging alternative energy sources such as landfill gas-to-energy facilities and solar energy.

Fire Protection

There are 41 fire departments and fire stations in San Joaquin County. These are all within existing urban communities. Fire protection in the unincorporated portion of the county is provided by rural fire districts or adjacent city fire departments. More remote areas are under the jurisdiction of the California Department of Forestry and Fire Protection (San Joaquin County, 2010).

The Stockton Fire Department serves the city and surrounding areas, including RD 17. The department has 80 emergency medical trained (EMT) personnel, 287 line suppression personnel, 38 civilian employees and twelve fire stations (City of Stockton, 2007). All the firefighters are certified as EMTs, with 111 firefighters certified to EMT-Paramedic level. The target response time is within 5 minutes.

RD 17 is served by the French Camp McKinley Fire District, which has one fire station located at 310 East French Camp Road in the town of French Camp and by the Lathrop-Manteca Fire Protection District, which has four fire stations placed throughout 100 square miles. The Lathrop-Manteca Fire Protection District serves the City of Lathrop and rural areas of Manteca and consists of: Fire Station 31, which is located at 800 East J Street in Lathrop; Fire Station 32, which is located at 22754 South Union Road in Manteca; Fire Station 33, which is located at 9121 East Lathrop Road in Manteca; and Fire Station 34, which is located at 460 River Islands Parkway (LMFD, 2010). The Lathrop-Manteca Fire District has a standard response time of 3 to 4 minutes (San Joaquin County LAFCo, 2009). The Manteca Fire Department serves the city of Manteca. There are three fire stations within the city limits. The Department also responds to medical emergencies. Their service standard is to maintain an average 5 minute response time for all emergencies (City of Manteca, 2003).

Police Services

San Joaquin County Sheriff Department provides law enforcement services for the unincorporated areas of the county. The Sheriff's office also staffs a boating safety division. The County Sheriff department has 124 patrol officers that rotate shifts to provide law enforcement services 24 hours a day, 7 days per week (San Joaquin County 2009b). Stockton and Manteca each maintain a city police department. The Stockton Police Department currently has about 1 officer to 693 citizens and an emergency response time between three and five minutes (City of Stockton, 2007). The Manteca Police Department has a standard of one officer for every 1,000 residents. The Department has over 200 active volunteers who assist the Department and the community. The City of Lathrop Police Department includes 24 officers, 19 deputy sheriffs and four civilian staff members. The City of Lathrop contracts with the San Joaquin County Sheriff's Department for law enforcement services and Lathrop police officers are San Joaquin County deputy sheriffs assigned to the City of Lathrop. San Joaquin County and the City of Lathrop have a flexible police staff agreement that accommodates modifications to service levels. Emergency response time within the core city is 2 to 4 minutes (San Joaquin County LAFCo, 2009).

5.16.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature review and accepted standards of professional practice.

Basis of Significances

A project alternative would have a significant impact related to utilities and public services if it would:

- Result in substantial adverse physical impacts associated with the need for of new or physically altered public service or facilities, including police service, fire protection, school, library, drinking water, wastewater and stormwater collection facilities;
- Substantially increase need for new or physically altered public service or facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objective;
- Require new or expanded entitlements to provide sufficient water supplies to serve the project;
- Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects;
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects; or
- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs.

Effects and Mitigation Measures

The project would not involve any changes in land use that would increase short term or long term demand for public services, including fire and police protection, schools, parks and other public facilities, thus necessitating the construction of new or altered government service facilities. Similarly, the project would not result in demand for increased natural gas facilities, electrical transmission lines, communication systems, water infrastructure, sewer lines or solid waste facilities beyond their current capacity. These issues do not apply to this analysis and are not addressed further.

5.16.3 ALTERNATIVE 1 - NO ACTION

With implementation of Stockton's General Plan, future growth would not exceed the capabilities or capacity of Stockton to provide utilities and public services, including police service, fire protection, schools, libraries or drinking water, wastewater and stormwater collection facilities.

Although anticipated growth would require improvement of public services and facilities, the impacts of induced development resulting from improved utilities and services would be mitigated to **less than significant** through implementation of City of Stockton policies and regulations.

Flooding that occurs under the No Action Alternative would result in backflow of stormwater facilities, including a 72-inch storm line which drains into Old Mormon Slough and storm drains for the subdivisions located south of Highway 120 in RD 17. Drainage pumping stations along the Calaveras River and along the north side of Smith Canal would remain below the 100-year flood elevation. Floodwaters would also exceed the pumping capacity of the Stockton Municipal Utilities District Waste Water Treatment plant, resulting in internal flooding of the plant and loss of service to over 300,000 customers (Emergency maps). For floods which occur under the No Action Alternative, emergency actions would be required to protect California Water Service's water supply system and East Bay Municipal Utility District's aqueduct along

the north bank of the Calaveras River. The magnitude of the impact from levee failure would depend on the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore, identification of potential effects is **too speculative for meaningful consideration**.

5.16.4 ALTERNATIVE 7A

Project implementation would encroach on multiple types of utility equipment and facilities, including storm drains, irrigation lines, electric power lines and gas pipelines. Project construction activities, including grading and excavation, would require removal or reconnection of facilities and could damage identified and unidentified utility equipment and facilities. Substantial temporary interruptions of irrigation supply could occur if irrigation infrastructure is damaged or otherwise rendered inoperable at a time when it is needed (e.g., if reconnections to water supply sources are not completed by the time crop irrigation must begin). In addition, required relocation of existing electrical lines and gas pipelines could interrupt service. Design of the project would include consultation with all known service providers to identify infrastructure locations and appropriate protection measures and consultation would continue during construction to ensure that facilities are avoided and protected to minimize service disruptions as construction proceeds. Construction would not require the construction of new or expanded utility systems, including water supply facilities. Any connections to the municipal utility system would be coordinated with the appropriate utility provider prior to construction. The extent and intensity of project construction activities, however, may affect service providers' abilities to quickly repair damage and/or restore interrupted service. This impact is considered **significant**. However, implementation of mitigation measures would reduce potential impacts to a **less than significant** levels.

5.16.5 ALTERNATIVE 7B

The footprint of Alternative 7b is greater than that of Alternative 7a, because it extends along the northern, western and southern levees of RD 17. The action and impacts of Alternative 7a are the same as Alternative 7b in North and Central Stockton, but would be greater because they also extend to RD 17. The extent and intensity of project construction activities may affect service providers' abilities to quickly repair damage and/or restore interrupted service. This impact would be **significant**, but implementation of mitigation measures would reduce potential impacts to a **less than significant** level.

5.16.6 ALTERNATIVE 8A

The footprint of Alternative 8a is the same as the footprint of Alternative 7a, except that it extends further up Lower Calaveras River and along the Stockton Diverting Canal. The construction actions and impacts would be the same as those described for Alternative 7a, but would be greater because they extend further upstream on the Calaveras River and along the Stockton Diverting Canal. The extent and intensity of project construction activities may affect service providers' abilities to quickly repair damage and/or restore interrupted service. This impact would be **significant**. However, implementation of mitigation measures would reduce potential impacts to a **less than significant** level.

5.16.7 ALTERNATIVE 8B

The footprint of Alternative 8b is the same as the footprint of Alternative 7a, except that it extends further up Lower Calaveras River and along the Stockton Diverting Canal and, like Alternative 7b, it includes construction work and impacts in RD 17. Therefore, the extent of construction activities and potential impacts are greater than those described for Alternative 7a and Alternative 7b. The extent and intensity of project construction activities may affect service providers' abilities to quickly repair damage and/or restore

interrupted service. This impact would be **significant**. However, implementation of mitigation measures would reduce potential impacts to a **less than significant** level.

5.16.8 ALTERNATIVE 9A

The footprint of Alternative 9a is the same as the footprint of Alternative 7a, except that it includes a new flood bypass and channel improvements in Old Mormon Slough. In addition to the impacts described for Alternative 7a, a buried in-channel concrete box culvert constructed from Commerce Street to just upstream of Wilson Way collects much of the local drainage, including flows from 25 storm drains in this area. Under the channel improvements proposed in Alternative 9a, the culvert would be removed and the storm drains would be redirected to discharge directly into Mormon Channel. Therefore, the extent of construction activities and potential impacts are greater than those described for Alternative 7a. The extent and intensity of project construction activities may affect service providers' abilities to quickly repair damage and/or restore interrupted service. This impact would be **significant**. However, implementation of mitigation measures would reduce potential impacts to a **less than significant** level.

5.16.9 ALTERNATIVE 9B

The footprint of Alternative 9b is the same as the footprint of Alternative 7a, except that it includes a bypass and channel improvements through Old Mormon Slough and, like Alternative 7b and 8b, it includes construction work and impacts in RD 17. In addition to the impacts described for Alternative 7a, 25 storm drains connect into a buried in-channel concrete box culvert upstream of Wilson Way on Old Mormon Slough. Under the channel improvements proposed in Alternative 9b, the culvert would be removed and the storm drains would be redirected to discharge directly into the Mormon Channel Bypass. The extent and intensity of project construction activities may affect service providers' abilities to quickly repair damage and/or restore interrupted service. This impact would be **significant**. However, implementation of mitigation measures would reduce potential impacts to a **less than significant** level.

5.16.10 MITIGATION

Mitigation would be the same for all of the action alternatives. Before beginning construction, coordination with utility providers to implement orderly relocation of utilities that need to be removed or relocated would occur. Coordination would include the following:

- Notification of any potential interruptions in service shall be provided to the appropriate agencies and affected landowners.
- Before the start of construction, utility locations shall be verified through field surveys and the use of Underground Service Alert services. Any buried utility lines shall be clearly marked where construction activities would take place and on the construction specifications before of any earthmoving activities begin.
- Before the start of construction, the contractor would be required to coordinate with the local municipality and acquire any applicable permits prior to use of municipal water for construction.
- Before the start of construction, a response plan shall be prepared to address potential accidental damage to a utility line. The plan shall identify chain of command rules for notification of authorities and appropriate actions and responsibilities to ensure the public and worker safety. Worker education training in response to such situations shall be conducted by the contractor. The response plan shall be implemented by the contractor during construction activities.
- Utility relocations shall be staged to minimize interruptions in service.

Implementation of this mitigation measure would reduce impacts caused by disruption of utility services under Alternatives 7a, 7b, 8a, 8b, 9a and 9b, to a **less than significant** level because the construction contractor would coordinate with service providers and consumers to minimize interruptions to the maximum extent feasible. A response plan to address service interruptions would be prepared and implemented.

5.17 RECREATION

This section describes the affected environment and environmental consequences relating to recreation for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed.

5.17.1 ENVIRONMENTAL SETTING

Regulatory Framework

No Federal, State, regional or local plan, policies, regulations, laws or ordinances related to recreation apply to the proposed LSJR project.

Existing Conditions

The City of Stockton maintains 63 parks, 106 miles of bicycle facilities and two public boat launch facilities. San Joaquin County offers boating (one public boat launch in the project area), fishing and camping opportunities at 6 regional parks. Privately owned marinas, country clubs and golf courses provide additional recreational opportunities within the study area.

Three public boat launch facilities are located along project reaches: the Buckley Cove Boat Launch on the SJR north of the Calaveras; Louis Park Boat Launch at the confluence of Smith Canal; and Dos Reis Regional Park on the SJR north of Old River. The City-owned facilities provide day-use picnic areas and fishing opportunities; the county-owned Dos Reis Regional Park offers RV and tent camping in addition to day-use areas.

Waterways in the project area are used for recreational boating and fishing throughout the year. The private Village West Marina is located in northwest Stockton on Fourteenmile Slough, which is the primary waterway connecting the marina to the rest of the Delta and the SJR. Houseboats are present in Smith Canal.

Several existing Class I bike trails follow the alignment of Stockton's waterways. The 6-mile bike trail along the north side of the Calaveras River and Stockton Diverting Canal provides an attractive corridor for cyclists. A bike trail also runs along the SJR between Henry Long Boulevard and Manthey Road (north and east along French Camp Slough). The city plans to increase bicycle facilities along Bear Creek, Mosher Slough, Old Mormon Slough and the SJR. The city plans to extend the existing bike path along the Calaveras River and to construct 5 bridges for pedestrians and cyclists (City of Stockton, 2007b).

Four golf and country clubs are located directly adjacent to project streams: Oakmore, adjacent to the Stockton Diverting Canal (this golf course is closed); Brookside, at the junction of the Calaveras River and the SJR; Stockton Golf and Country Club, adjacent to the SJR; and Van Buskirk along French Camp Slough.

5.17.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature review and accepted standards of professional practice.

Basis of Significance

The proposed project would have a significant impact on recreational resources if it 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; or
- Would result in substantial adverse physical impacts associated with the need for new or physically altered parks or recreational facilities.

5.17.3 ALTERNATIVE 1 - NO ACTION

Stockton offers recreational opportunities through public parks and would be able to maintain sufficient recreational area to population ratios to meet future needs for recreational opportunities without adversely impacting other resources. Boating opportunities would not be adversely impacted. Following the Stockton General Plan (2007), bicycle paths along the Calaveras River, Bear Creek, Mosher Slough, the Stockton Channel, Mormon Slough and SJR would be developed by 2035.

If a flood event were to occur, park facilities could be covered with sediment and the facilities could be damaged. Additionally, bike paths and running trails which are adjacent to the levee would likely be damaged and unusable for an extended period of time. The magnitude of the impact resulting from levee failure would depend on the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on the information available at this time. Therefore identification of potential effects is **too speculative for meaningful consideration**.

5.17.4 ALTERNATIVE 7A

Implementation of Alternative 7a would temporarily disrupt recreational activities on and along the Calaveras River and SJR and at Louis Park. Construction activities such as grading, removing vegetation, trenching, constructing cutoff walls and placing seepage berms would affect the scenery and thus passive recreational activities (e.g., walking, photography, bird watching). Most impacts would be temporary because construction-related equipment that would be visible from recreational facilities (i.e., open space and Calaveras and SJRs) would be removed after completion of construction activities.

In addition, recreational access to Dad's Point on Smith Canal would be closed for two to three construction seasons. The Buckley Cove, Louis Park and Dos Reis Park parking lots could be used for staging of materials and equipment, potentially affecting use of the boat ramps and disrupting passive recreational opportunities for two to three construction seasons. Three additional public boat launches, including the Morelli Park Boat Launch, would be available to access the SJR during any closures.

The gate structures across Smith Canal and Fourteenmile Slough would each have a 50 foot opening for boat passage and would be exercised (i.e., closed and immediately opened) once or twice a year. Gate operations and the conditions, frequency and duration of gate closures are described in Section 4.5.6. Operation of the closure structures would be relatively infrequent except during January and February high tides (8.0 ft+) when the gates would close up to 10 times per month and remain closed for a few hours up to 24 hours. Gates would be closed for short durations except during flood events which would be expected to occur about every 2 to 3 years. When flood events together with high tides occur, the gates could remain closed from a few days to a few weeks. Therefore, these closure structures would not have significant permanent impacts to recreation.

During construction, the SJR would be inaccessible from the Louis Park boat launch and docks along the Smith Canal for half a year as the closure structure and dual sheetpile wall are completed. Similarly, Fourteenmile Slough would also be inaccessible for about half a year from Fivemile Slough westward to where Fourteenmile bifurcates around Rindge Tract. This would disrupt access to the Delta for boaters traveling into and out of Village West Marina.

The waterways in the project area would remain accessible; however, there would be temporary impacts to boating and recreational opportunities which would be short term to those along the Smith Canal and Fourteenmile Slough. Similarly, once construction is complete, boaters, including those using the Village West Marina, would have access to the SJR and Fourteenmile Slough.

The construction of Alternative 7a would require extensive work on the levee crown, which would disrupt bicycling and jogging along the Calaveras River Bike trail and the SJR Bike Trail. Detours would likely be required along 3 miles of bike trail during each 5-month construction season in these reaches. Impacts would be temporary because the bike trails would be restored after construction is complete. Implementation of Alternative 7a would not affect the City's long term plans to improve and extend the existing bicycle network. Impacts to recreation, to boating opportunities and bicycle paths would be **less than significant**.

Removal of trees and shrubs to construct structural project features and to establish compliance with the Vegetation ETL could adversely affect the recreational experience by changing the view-shed and the microclimate (i.e., reducing the amount of shade available). Vegetation removal would also reduce habitat for wildlife, such as birds, thereby reducing their presence on or adjacent to the levees in the project area.

There are many recreation facilities in the study area that would not be affected by project construction and would continue to provide recreation opportunities. Detour routes and alternative access would allow recreation activities to continue during the construction season. The project would not generate the need for additional recreation facilities or generate additional recreation needs.

Although a limited number of people would be affected by the project and additional recreational facilities would not be required as a result of the project, the effects to recreation would be **significant and unavoidable** because of short and long term impacts to the visual quality of the experience, reduced shade and reduced opportunity for bird watching and wildlife viewing.

5.17.5 ALTERNATIVE 7B

Implementing Alternative 7b would have the same recreation impacts as Alternative 7a in North and Central Stockton. In addition, implementing Alternative 7b would temporarily disrupt recreational activities on and along the SJR adjacent to RD 17; at Mossdale County Park; and in the open spaces in RD 17. As for Alternative 7a, most impacts would be temporary because construction-related equipment that would be visible from recreational facilities (i.e., open space and Mossdale County Parks, Calaveras and SJRs) would be removed after completion of construction activities.

Impacts to recreation resulting from construction of the gate structure across Smith Canal would be the same as those described for Alternative 7a. The waterways in the project area would remain accessible; however, there would be temporary impacts to boating and recreational opportunities which would be short term to those along the Smith Canal.

The construction of Alternative 7b would require extensive work on the levee crown, which would disrupt bicycling, walking and jogging along the Calaveras River Bike trail and the SJR Bike Trail; detours would likely be required along 3 miles of bike trail during each 5-month construction season in these reaches. Impacts would be temporary because the bike trails would be restored after construction is complete. Implementation of Alternative 7b would not affect the city's long-term plans to improve and extend the existing bicycle network.

There are many recreation facilities in the study area that would not be affected by project construction and continue to provide recreation opportunities. Detour routes and alternative access would allow recreation activities to continue during the construction season. The project would not generate the need for additional recreation facilities or generate additional recreation needs. However, there would impacts to visual quality, reduced shade and wildlife viewing opportunities would extend throughout the project area in RD 17. These impacts would be **significant and unavoidable** in both the short and long-term.

5.17.6 ALTERNATIVE 8A

Alternative 8a would include the same project impacts as those in Alternative 7a, but would also include additional construction along portions of the Lower Calaveras River and the Stockton Diverting Canal. The Stockton Diverting Canal and the additional portions of the Lower Calaveras River that are included have few trees and shrubs to contribute to the recreational experience. Affects to recreation from implementing Alternative 8a would be **significant and unavoidable** because of short and long term impacts to the visual quality of the experience, reduced shade and reduced opportunity for bird watching and wildlife viewing.

5.17.7 ALTERNATIVE 8B

Implementation of Alternative 8b would result in the same recreation impacts as Alternative 7b, except Alternative 8b includes additional levee improvements along the Upper Calaveras River and on the Stockton Diverting Canals. Alternative 8b would temporarily disrupt recreational activities on and along the Calaveras River and SJR; at Louis Park and Mossdale County Park; and in the open spaces in RD 17. The types of impacts are consistent with the descriptions under Alternative 7b.

The waterways in the project area would remain accessible; however, there would be temporary impacts to boating and recreational opportunities which would be short term to those along the Smith Canal and Fourteenmile Slough. Similarly, once construction is complete, boaters, including those using the Village West Marina would have access to the SJR and Fourteenmile Slough.

The construction of Alternative 8b would require extensive work on the levee crown, which would disrupt cycling and jogging along the Calaveras River Bike trail and the SJR Bike Trail; detours would likely be required along 3 miles of bike trail during each 5-month construction season in these reaches. Impacts would be temporary, because the bike trails would be restored after construction is complete. Implementation of Alternative 8b would not affect the city's long-term plans to improve and extend the existing bicycle network.

There are many recreation facilities in the study area that would not be affected by project construction and continue to provide recreation opportunities. Detour routes and alternative access would allow recreation activities to continue during the construction season. The project would not generate the need for additional recreation facilities or generate additional recreation needs.

Although a limited number of people would be affected by the project and additional recreational facilities would not be required as a result of the project, the affects to recreation would be potentially **significant and unavoidable** because of short term and long term impacts to the visual quality of the experience, reduced shade and reduced opportunity for bird watching and wildlife viewing.

5.17.8 ALTERNATIVE 9A

Alternative 9a would consist of the same repairs along the same linear extent as described for Alternative 7a, with the exception that Alternative 9a also includes improvements to Old Mormon Slough. This abandoned channel is not currently open to the public. The proposed channel improvements would allow for future development of walking trails, which could increase passive recreational opportunities. Although recreational improvements are not planned as a part of this project and would thus be too speculative for a precise determination of impact, permanent impacts in the Old Mormon Slough are expected to be positive or less than significant.

For the reasons described for Alternative 7a, Alternative 9a would result in affects to recreation would be potentially **significant and unavoidable** because of short and long term impacts to the visual quality of the experience, reduced shade and reduced opportunity for bird watching and wildlife viewing.

5.17.9 ALTERNATIVE 9B

Alternative 9b would consist of the same repairs along the same linear extent as Alternative 7b, with the exception that Alternative 9b also includes improvements to Old Mormon Slough, making it into the Mormon Channel flood bypass. This old slough is not currently open to the public; the proposed channel improvements would allow for future development of walking trails, which could increase passive recreational opportunities. Although recreational improvements are not planned as a part of this project and would thus be too speculative for a precise determination of impact, permanent impacts in the Old Mormon Slough are expected to be positive or less than significant.

For the reasons described for Alternative 7b, the affects to recreation would be potentially significant and unavoidable because of short and long term impacts to the visual quality of the experience, reduced shade and reduced opportunity for bird watching and wildlife viewing.

5.17.10 MITIGATION

Detours and alternative recreation locations would provide sufficient recreation opportunities in the study area. Impacts resulting from the loss of vegetation would be mitigated on site, where feasible, through additional plantings in existing parks. Approaches to mitigate for loss of vegetation are in Section 5.9. Implementing these measures would reduce impacts to recreation that are associated with vegetation. However, impacts to the recreational experience due to vegetation removal and the resulting changes in the visual quality, shade and reduced opportunities for bird watching and wildlife viewing would remain **significant and unavoidable**.

5.18 AESTHETICS

This section describes the affected environment and environmental consequences relating to aesthetics for the LSJR project and the significance of the impacts and mitigation measures to reduce impacts.

5.18.1 ENVIRONMENTAL SETTING

Regulatory Framework

No Federal, State, regional or local plans, policies, regulations or laws related to aesthetics apply to the proposed LSJR project.

Existing Conditions

An area's visual character is determined by the variety of visual features present, the quality of those features and the scope and scale of the scene. The visual components of a particular area consist of such features as landforms, vegetation, man-made structures and land use patterns. The quality of these features depends on the relationship between them and their scale in the overall scene.

In assessing the aesthetic effects of a project, the visual sensitivity of the site must be considered. Areas of high visual sensitivity are easily visible to the general public. Scenic highways, tourist routes and recreation areas generate sensory reactions and evaluations by the observer. The evaluations of a particular scene will vary depending on the perceptions and values of the observer. The determination of significance of potential aesthetic effects is based on the change in visual character as determined by the obstruction of a public view, creation of an aesthetically offensive public view or adverse changes to objects having aesthetic significance.

The North and Central Stockton portions of the project area consist of a diverse range of urban settings, with potential observers ranging from homeowners to passing joggers. In some residential areas, homeowners' properties extend up and over the levee and vary from well-landscaped backyards to weedy lots. Many homeowners in these reaches set out umbrellas and chairs to enjoy the peaceful waterfront views (Figure 5-19).

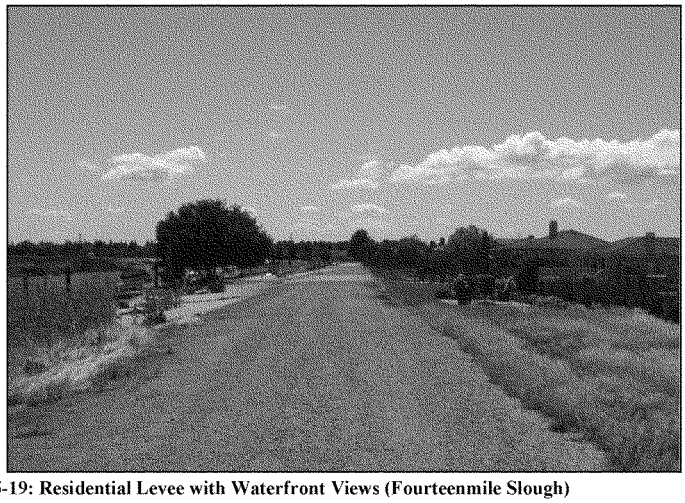


Figure 5-19: Residential Levee with Waterfront Views (Fourteenmile Slough)

In areas where public levee access is permitted, the streams provide an important visual amenity to joggers and passersby, contrasting with the neatly laid-out residential parcels in rows on the landside of the levee. Reaches with riparian vegetation and wildlife add visual heterogeneity and dynamic qualities to the otherwise barren levees. Graffiti and trash detract from the aesthetics of non-residential areas, particularly trash in the Old Mormon Slough (Figure 5-20) and graffiti on the Calaveras River floodwall.

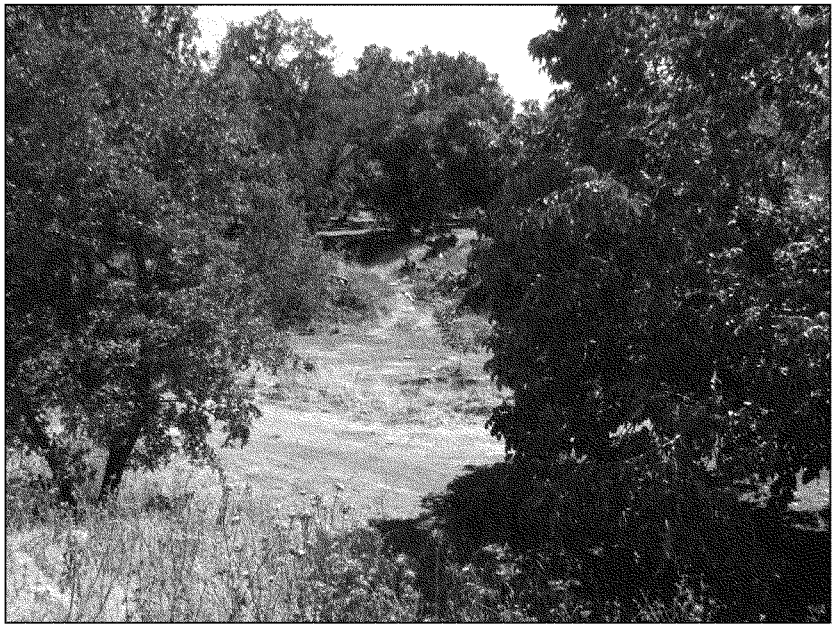


Figure 5-20: Old Mormon Slough

Views in the RD 17 portion of the Project Area are characterized by the SJR, adjoining waterways and the existing dry land levee. The visual characteristics of RD 17 contrast starkly with the urban setting of North and Central Stockton. These reaches are rural, dominated by row cropping and orchards on the landside. The higher variety of waterside vegetation in these reaches adds to the visual appeal, although there are fewer potential observers due to restrictions on public access and lower population density in the area. Sensitive viewers include nearby residents and farmers, motorists and people recreating at parks and open spaces along the levee system.

5.18.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature and accepted standards of professional practice.

Basis of Significance

The implementation of the proposed project would have a significant impact on visual and aesthetic quality if it would:

- Substantially or demonstrably result in a negative aesthetic alteration to the existing character of the area. A substantial alteration is characterized by a negative "sense of loss" of character or unique resources;
- Have a substantial adverse effect on a scenic vista; or
- Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area.

5.18.3 ALTERNATIVE 1 - NO ACTION

Features that define the character of the area identified by the Stockton General Plan (2007include open space areas, agricultural fields and riparian areas in addition to residential communities and commercial development. Depending on climate conditions, residents of Stockton can view the Coastal Range and the Sierra in the distance. As Stockton grows, land use changes and air quality impacts associated with development are likely to impact some of these features. The General Plan contains policies that work in conjunction with current city design and development regulations to ensure that new development complements the existing aesthetic fabric of city of Stockton and its surrounding environment and does not threaten scenic corridors. Even with mitigation measures, however, the development outlined in the General Plan would create new sources of light and glare.

Under the No Action Alternative, a substantial risk of flooding would remain. Flooding resulting either from a localized levee failure or simultaneous levee failures in more than 1 location in the levee system, could cause damage to structures. The No Action Alternative could have a significant effect on the character of the residential and commercial areas depending on the extent and duration of flooding and subsequent repair. Construction would be required to repair flood damage, resulting in the presence and movement of heavy construction equipment and potential temporary sources of light and glare.

Future flooding would not degrade the physical appearance of features which contribute to scenic vistas, including farmlands, open space and riparian habitats along the SJR and tributaries. Although farmlands are functionally impacted following flooding, they remain open spaces and continue to contribute to the rural quality of views. Similarly, riparian habitats may be damaged, but would retain the undeveloped appearance which contributes to the scenic views. Flooding does not affect light or glare. Therefore, impacts on aesthetics would be **less than significant**.

5.18.4 ALTERNATIVE 7A

Installation of the closure structure at Smith Canal would result in a large wall across most of the opening. The wall would degrade the physical appearance of open water features which contribute to scenic vistas. Additionally, the floodwall along Dad's Point would become a physical barrier to the view of the open waters from the park area and some homes.

Project improvements with full vegetation removal would not create any new sources of light or glare. However, removal of trees and shrubs would reduce shade and expose the area to sunlight throughout the day and to glare and light at sunrise and sunset. Complete removal of waterside vegetation would also alter the experience and the quality of views for nearby sensitive receptors. Vegetation removal would greatly reduce or eliminate riparian habitat, which contributes to scenic vistas and the existing visual character of the site. Post project foreground views would be drastically different from pre-project foreground views. Since no mitigation would be feasible for the complete removal of waterside vegetation or from effects on views from the Smith Canal and floodwall, these impacts would be permanent, **significant and unavoidable**.

5.18.5 ALTERNATIVE 7B

Visual impacts under Alternative 7b would be similar in nature but greater in extent than those described for Alternative 7a. The increase in extent results from construction that would occur along the northern, western and southern levees in RD 17. Since no mitigation would be feasible for the complete removal of waterside vegetation, these impacts would be permanent, **significant and unavoidable**.

5.18.6 ALTERNATIVE 8A

Visual impacts described for Alternative 7a would be the same as Alternative 8a at the Smith Canal closure structure and Dad's Point, as would impacts with vegetation removal. Since no mitigation would be feasible for the complete removal of waterside vegetation, these impacts would be permanent, **significant and unavoidable**.

5.18.7 ALTERNATIVE 8B

Visual impacts described for Alternative 7a above would be the same for Alternative 8b at the Smith Canal closure structure and Dad's Point, as would impacts with vegetation removal. Since no mitigation would be feasible for the complete removal of waterside vegetation, these impacts would be permanent, **significant and unavoidable**.

5.18.8 ALTERNATIVE 9A

Visual impacts under Alternative 9a would be the same as those described for Alternative 7a except that the visual landscape will change on Old Mormon Slough as a result of converting it into a flood bypass. Since no mitigation would be feasible for the complete removal of waterside vegetation, these impacts would be permanent, **significant and unavoidable**.

5.18.9 ALTERNATIVE 9B

Visual impacts described for Alternative 7b would be the same for Alternative 9b at the Smith Canal closure structure and Dad's Point, as would impacts with vegetation removal. Since no mitigation would be feasible for the complete removal of waterside vegetation, these impacts would be permanent, **significant and unavoidable**.

5.18.10 MITIGATION

No mitigation is feasible for the Smith Canal closure structure and the wall along Dad's Point. USACE would seek opportunities during the design phase of the project to plant onsite vegetation, if a variance is received, which would reduce impacts to aesthetics. However, impacts from compliance with the Vegetation ETL would remain **significant and unavoidable**.

5.19 NOISE

This section describes the affected environment and environmental consequences relating to noise for the LSJR project. The significance of the impacts and mitigation measures to reduce impacts are also discussed.

5.19.1 ENVIRONMENTAL SETTING

Regulatory Framework

Laws, regulations and requirements that apply to noise are listed below and summarized in Chapter 7, Compliance with Applicable Laws, Policies and Plans.

Federal

- Executive Order 11988, Floodplain Management
- Noise Control Act (42 USC §§ 4901-4918)

State

- California Code of Regulations, Title 24
- State of California General Plan Guidelines (OPR 2003)

Local

- California Land Conservation Act of 1965 (Williamson Act)
- City of Manteca General Plan 2003 (Goal N-I; Goal N-4, Policy N-P-1, Policy N-P-4, Policy N-P-5, Policy N-P-7; Implementation N-I-3; Implementation N-I-4
- City of Manteca Zoning Ordinance, Manteca Municipal Code 2003 – Title 17-Zoning
- Comprehensive General Plan for the City of Lathrop, California (City of Lathrop 2004)
- City of Stockton General Plan (2007)
- San Joaquin County Plan (2010)

Existing Conditions

North and Central Stockton portions of the project area are primarily urban, with a mix of residential and industrial land uses. RD 17 is a rural, predominantly agricultural area and is relatively quiet. The primary sources of noise in North and Central Stockton include traffic along I-5, State Route 99 and several local roadways, intermittent trains and the Port of Stockton's loading operations along the Stockton Deep Water Ship Channel. Ambient sounds in RD 17 include birds and distant traffic. Farming operations and intermittent trains are the primary sources of noise greater than ambient conditions in RD 17.

Noise varies over time, as background noise gradually increases and decreases throughout the day and as short term noise events such as sirens or passing aircraft are added to the ambient noise levels. Thresholds for noise exposure are normally expressed with statistical noise descriptors such as an average daily exposure level over an extended period of time or average day-night sound level (Ldn). To account for greater noise sensitivity during evening hours, nighttime noise exposure is more heavily weighted than daytime exposure in the calculation of Ldn. Short term noise levels measured over a brief period are expressed as Leq. Sound intensity is measured in decibels (dB). Because the intensity of noise does not increase linearly with increasing dB, noise levels are often expressed using the A-scale (dBA), so that a doubling of dBA represents a doubling of intensity. The EPA has defined 55 DBA Ldn as the goal for residential environments (USEPA, 1974).

The City of Stockton measured ambient noise levels throughout the city during the development of the 2007 General Plan. A short term (10-15 minute) noise measurement was taken in Sandman Park on the north side of Mosher Slough. Estimated typical Ldn (day-night average sound level) for this location was 61 dB, with a maximum sound level of 94 dB (Background Report). Ldn generated by vehicle traffic along I-5 and SR-99 and railroad traffic along the Union Pacific Railroad (UPRR) and Burlington Northern Santa Fe (BNSF) dominate the noise environment where these routes cross the project reaches.

Railroads cross the project area in several locations including the Calaveras River, Stockton Diverting Canal, SJR and Old Mormon Slough. The operations include both freight and passenger service and about half occur between 7 a.m. and 10 p.m. UPRR operates a total of 43 trains per day and BNSF operates 50 trains per day. Without warning horns, the approximate Ldn 424 feet from the tracks is 65 dB. With warning horns, the noise 414 feet from the tracks increases to 70 dB.

Table 5-38: Approximate Distances to UPRR Noise Contours

Ldn Noise Level (dB)	Distance to Noise Contour with warning horns (feet)	Distance to Noise Contour without warning horns (feet)
60.0	1,969	914
65.0	914	424
70.0	424	197

(Source: Draft EIR for Stockton General Plan, pg 11-1)

5.19.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

This assessment is based upon a literature review and accepted standards of professional practice.

Basis of Significance

Implementation of a project alternative would result in a significant noise impact if it would:

- Expose people to or generate noise levels in excess of, standards established in the local general plan, noise ordinance or applicable standards of other agencies;
- Expose people to or generate excessive groundborne vibration or groundborne noise levels;
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project; or
- Result in the encroachment of incompatible land uses near known noise producing industries, railroads, airports and other sources.

The proposed project would not modify the existing or planned land use and would not be located in the vicinity of any public or private airports; therefore, none of the proposed alternatives would result in the encroachment of incompatible land uses near known noise-producing sources. Future O&M of the project levees would require regular control of all vegetation on and adjacent to the levees. The equipment required for this maintenance would be similar to what is currently used. Therefore, none of the proposed alternatives would result in a substantial permanent increase in ambient noise levels. These effects will not be discussed in further detail.

Federal

The Federal Transit Administration (FTA) issued guidance for noise and vibration impact assessment of Federally-funded mass transit projects (FTA, 2006). Although specifically intended for construction of mass transit projects, the FTA guidelines will be used as a threshold of potential significance for the proposed project. The impact criteria are listed in Figure 5-21 for noise and Table 5-39 for vibration.

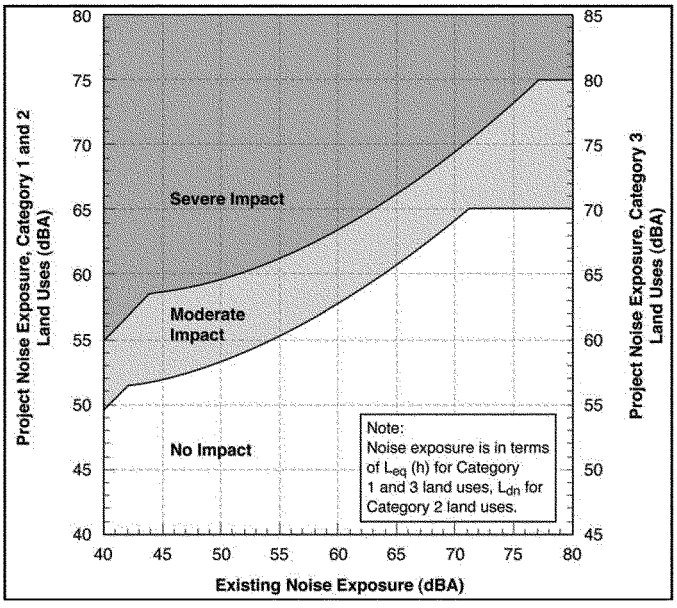


Figure 5-21: Noise Impact Criteria for Transit Projects (FTA 2006)

Depending on the existing noise levels at the receptor, FTA noise impact thresholds range from 50 dB L_{eq} to 65 dB L_{eq} for Land Use Categories 1 and 2 and 55 dB L_{eq} to 70 dB L_{eq} for Land Use Category 3. Land Use Category 1 includes lands set aside for serenity and quiet, such as recording studios, outdoor amphitheaters and concert pavilions; as well as National Historic Landmarks. Land Use Category 2 includes buildings where people normally sleep and where nighttime sensitivity to noise is high, such as homes and hospitals. Land Use Category 3 includes institutional land uses with primarily daytime and evening use such as schools, libraries and churches.

Vibration is an oscillatory motion that is measured in vibration decibels (VdB). The effects of vibration can include movement in floors and rattling of windows and items on shelves and other surfaces. It can also include sensations detectable in the bodies of humans and other animals. The magnitude, frequency and duration of exposure to vibration all contribute to the impacts of vibration. Vibration in the range of 50 VdB to 100 VdB is of interest. Humans typically perceive vibration when it reaches 65 VdB, but vibration levels do not become bothersome until they exceed 70 VdB (FTA, 2006).

Vibration thresholds range from 65 VdB to 83 VdB depending on the event frequency and the land use category (Table 5-39). "Frequent events" are defined as more than 70 vibration events of the same source per day. "Occasional events" are defined as between 30 and 70 vibration events of the same source per day. "Infrequent events" are defined as fewer than 30 vibration events of the same kind per day. Land use Category 1 includes buildings where vibration would interfere with interior operations. The vibration threshold for this category is 65 Vdb. Category 2 includes residences and buildings where people normally sleep. The vibration threshold for this category is 72 VdB for frequent events, 75 VdB for occasional events and 80 VdB for infrequent events. Category 3 includes institutional land uses with primarily daytime use. The vibration threshold for this category is 75 VdB for frequent events, 78 VdB for occasional events and 83 VdB for infrequent events. Receptors with primarily daytime use or which experience relatively infrequent vibration events have higher annoyance thresholds (65-83 VdB) than receptors with nighttime use and/or frequent vibration events (65-75 VdB).

Table 5-39: FTA Groundborne Vibration Impact Criteria for General Assessment

Land Use Category	GBV Impact Levels (VdB re 1 micro-inch/sec)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB	65 VdB	65 VdB
Category 2: Residences and Buildings where people normally sleep	72 VdB	75 VdB	80 VdB
Category 3: Institutional Land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

Notes:
1. "Frequent Events" is defined as more than 70 vibration events of the same source per day.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.

Source: FTA, 2006. Transit Noise and Vibration Impact Assessment

State

State of California General Plan Guidelines

The Governor's Office of Planning and Research (OPR) published the State of California General Plan Guidelines (OPR, 2003), which provides guidance for the acceptability of projects within specific day-night average noise level (Ldn) contours. Generally, residential uses (e.g., mobile homes) are considered to be acceptable in areas where exterior noise levels do not exceed 60 A-weighted decibels (dBA) Ldn. Residential uses are normally unacceptable in areas exceeding 70 dBA Ldn and conditionally acceptable within 55–70 dBA Ldn. Schools are normally acceptable in areas up to 70 dBA Ldn and normally unacceptable in areas exceeding 70 dBA Ldn. Commercial uses are normally acceptable in areas with a community noise equivalent level (CNEL) of up to 70 dBA. Commercial uses are conditionally acceptable where the Ldn is between 67.5 and 77.5 dBA, depending on the noise insulation features of the building and the noise reduction requirements in the facility design. The OPR guidelines also provide adjustment factors for determining noise acceptability standards that reflect the noise control goals of the community, the particular community's sensitivity to noise and the community's assessment of the relative importance of noise pollution.

California Code of Regulations, Title 24

Title 24 of the California Code of Regulations establishes standards for interior noise levels that apply to all new, multifamily residential units. These standards require that acoustical studies be performed before construction begins at locations where the existing Ldn exceeds 60 dBA. Such acoustical studies are required to establish mitigation measures that limit maximum L_{dn} levels to 45 dBA in any habitable room. Although no interior noise standards are pertinent to all uses, many communities have adopted an Ldn of 45 dBA as an upper limit on interior noise in all residential units.

Local Criteria

Noise standards were established through general plans and noise ordinances for San Joaquin County, Manteca, Stockton and Lathrop. San Joaquin County Municipal Code (Section 9-1025.9[c][3]) specifically exempts construction activity occurring between 6:00 am and 9:00 pm on any day. Manteca Municipal Code (Section 17.058.050[d][8]) exempts construction conducted between 7:00 am and 7:00 pm as a part of an approved building permit. Stockton and Lathrop do not specifically exempt construction activities and review construction plans to determine whether the proposed project complies with the local ordinances. The City of Stockton General Plan states that "the City shall limit construction activities to the hours of 7am to 7pm, Monday through Saturday. No construction shall occur on Sundays or national holidays without a written permit from the City" and that "the City shall seek to limit the potential noise impacts of construction activities on surrounding land uses."

Although daytime construction noise may be exempt in some locations, exterior noise exposure criteria for Stockton, Lathrop, Manteca and San Joaquin County are presented as a means for determining potential significance (Table 5-40).

Table 5-40: Exterior Noise Exposure Criteria Applied to Stationary Noise Sources at Residential Receivers

Noise Level Descriptor	City of Stockton		City of Manteca		City of Lathrop		San Joaquin County	
	Day	Night	Day	Night	Day	Night		
L_{eq}	55	45	50	45	--	--	50	45
L_{max}	75	65	70	65	75	65	70	65

Sources: Stockton Municipal Code Section 16-60.040[b], San Joaquin County Municipal Code Section 9-1025.9[c][3], Manteca General Plan (2003), Lathrop General Plan (1991)

Other Considerations

Construction equipment and activities cause vibration. Some activities, like pile driving, can cause sharp and dramatic hydrostatic pressure waves and vibrations that can adversely affect all life stages of fish over relatively long distances (Washington et al. 1992). Hydrostatic pressure waves could rupture the swim bladders and other internal organs of all life stages of fish in the immediate construction area (Bonneville Power Administration 2002; Jones & Stokes Associates 2001; Washington et al. 1992). Additionally, noise and vibration generated by pile driving activities could have sublethal effects on individual fish by inciting movement into lower quality habitats (Bonneville Power Administration, 2002).

There is evidence that lethal effects can occur from pile driving, but accurately analyzing and addressing these, as well as sublethal effects (e.g., injury, temporary hearing threshold shifts, stress and behavioral disturbance) is complicated by several factors. Sound levels and particle motion produced from pile driving can vary depending on pile type and size, substrate composition and type of equipment used. Also, the effects of underwater noise vary among species as a function of species morphology and species

physiology. Further Oriard (1985) and Jones & Stokes Associates (2001) noted that the effects of energy resulting from blasting in rock adjacent to waterways differs depending on the composition and slope of the bank and specifically is reduced relative to in-water blasting. Presumably, pile driving activities on land result in similar reductions in energy transfer to waterways and thus would result in lesser effects than in-river activities. Therefore, the effects assessment qualitatively evaluates whether the project alternative would be anticipated to change conditions in the SJR, Stockton Deep Water Ship Channel, Smith Canal and/or the Delta sloughs in the project area as a result of hydrostatic pressure waves and increased noise and vibration caused by construction along the levee, floodwall and gate footprints.

5.19.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, the current level of risk for a major levee failure and flooding within the project area would remain. In the event of a levee breach, repair-related construction activities would occur. The location and extent of repair-related activities could be minor to extensive depending on the location and severity of the levee failure and duration of flooding. Repair-related construction activities would likely involve repairing damaged homes, utility infrastructure, roads and highways. Noise-sensitive land uses (i.e., residential uses) are dense throughout the area in which repair-related construction could be needed. Levee failure would likely result in evacuation of people (i.e., sensitive receptors) until levee repairs were completed. Without these sensitive receptors present, potential impacts related to temporary and short term construction noise and groundborne vibration associated with levee repair would not be anticipated and the impact would be **less than significant**.

5.19.4 ALTERNATIVE 7A

Construction of levee improvements under Alternative 7a would generate short-term and intermittent noise and vibration at or near individual noise- and vibration-sensitive locations along 23.6 miles of project reaches.

Noise

Construction activities associated with slurry cutoff walls would proceed in a linear manner, with noise levels of 50 dB L_{eq} or above affecting individual residences for up to 4 weeks in most locations. Activities associated with deep-soil mixing would also proceed in a linear fashion but more slowly, with noise levels of 50 dB L_{eq} or above affecting residences for 2 to 4 years depending on the number of rigs used.

Construction activities associated with levee widening and levee raises would involve recurring construction activities along the entire length of the site until construction is complete. On site equipment required for construction activities would include excavators, backhoes, bulldozers, scrapers, rollers, graders, loaders, compactors, pile drivers and various trucks.

Noise levels would fluctuate depending on the physical location of construction activities and on the type, number and duration of use of various construction equipment. Maximum noise levels produced by individual equipment during these operations could range from 80 to 90 dBA without the implementation of feasible noise control and at a distance of 50 feet from the nearest noise source, as indicated in Table 5-41. Construction noise attributable to the project was estimated using the FTA noise methodology for the prediction of the cumulative noise level generated by the three loudest pieces of equipment operating simultaneously (FTA, 2006). Table 5-42 shows the results for the various stages of construction activities for all alternatives, based on equipment requirements for construction listed in Chapter 4, Description of Final Alternatives. All results assume no intervening barriers.

Table 5-41: Typical Maximum Noise Level for Construction Equipment

Equipment Type	Typical Maximum Noise Level in dBA at 50 Feet
Dump Truck	88
Loader	86
Dozer	84
Grader	85
Vibratory Roller	82
Backhoe	85
Chain Trencher	85
Spreader	88
Paver	89
Water Truck	88
Backhoe/Skiploader	86
Pickup Truck	67
Forklift	86
Compactor	89
Pile Driver	101[1]
Concrete Truck	88
Concrete Pump	82
Deliver Truck	80
Crane	83

[1] FHA, Construction Noise Handbook, http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Table 5-42: Predicted Noise Levels Due to Major Construction Activities for All Alternatives

Action	Resulting noise level in dBA Leq at 100 feet	Distance to noise contour (Feet)			
		40 dBA Leq	45 dBA Leq	50 dBA Leq	55 dBA Leq
Clearing and grubbing/stripping	77.8	2750	1770	1147	740
Removal of landside structures and facilities	77.8	2750	1770	1147	740
Cutoff Wall Construction	77.8	2750	1770	1147	740
Seismic Deep Soil Mixing	77.8	2750	1770	1147	740
Seepage Berm Construction	77.8	2750	1770	1147	740
Closure Structure Construction	81.5	3802	2454	1584	1020
Restoration/ Demobilization	77.8	2750	1770	1147	740

Residences are dense throughout many of the areas in which construction would occur. Those residences adjacent to the construction footprint and haul routes would experience noise levels of 55 dB L_{eq} or greater. Individual sensitive receptors would be exposed to construction noise for several weeks to a full construction season, depending on the extent to which construction activities are staggered. Since short term, construction-related noise levels for Alternative 7a would exceed the applicable daytime standards of San Joaquin County (50 dBA L_{eq} during daytime for outdoor activity areas), City of Stockton (55 dBA L_{eq} during daytime for outdoor activity areas) and City of Manteca (50 dBA L_{eq} during daytime for outdoor activity areas), impacts would be **significant**. The use of noise-reducing construction practices would reduce noise levels, but impacts would remain **significant and unavoidable**.

Vibration

Construction activities under Alternative 7a would potentially result in varying degrees of temporary groundborne vibration, depending on the operations and equipment used. Vibration spreads through the ground and vibration levels decrease with increasing distance from the source. Table 5-43 lists the typical construction equipment vibration levels at a distance of 25 feet and the distance at which the vibration levels would be attenuated to 80 VdB or less.

Table 5-43: Typical Construction Equipment Vibration

Equipment		PPV	Lv at 25 ft	Ft to 80 VdB contour
Pile Driver (Impact)	Upper Range	1.518	112	625
	Typical	0.644	104	350
Pile Driver (vibratory)	Upper Range	0.734	105	375
	Typical	0.17	93	150
Large Bulldozer		0.089	87	90
Loaded trucks		0.076	86	85
Jackhammer		0.035	79	50

Construction of the closure structure at Smith Canal would require pile drivers. Whether vibratory pile drivers or impact pile drivers are used, the vibrations would not typically exceed the FTA standard (80 VdB for residential land uses) for any nearby sensitive receptors. However, the upper range for pile drivers could infrequently affect residences (i.e., sensitive receptors) which are within 625 feet of the closure structure construction. Because construction activities would be conducted only during the day time and because the vibration events in the upper range would likely occur infrequently, groundborne vibration from sheetpiling is unlikely to cause annoyance.

Equipment required for conventional and deep soil mixing cutoff wall construction would include truck-mounted augers, excavators, backhoes, bulldozers, scrapers, rollers, graders, loaders, compactors and various trucks. Ground vibration would also be generated by haul trucks on area haul routes. The most intense generation of ground vibration would be associated with large bulldozers, which generate levels of 87 VdB at a distance of 25 feet. These levels would attenuate to 80 VdB at a distance of 90 feet. Vibration-sensitive receptors (i.e., residences) are located adjacent to haul routes and adjacent to the levee within 90 feet of the maximum construction limit areas. Vibration could exceed the FTA standard (80 VdB) for human annoyance at these receptors, although no nighttime hauling or construction activities would occur and sleep would not be disturbed. For Alternative 7a, the vibration impacts associated with levee construction and material hauling would thus be **significant**. The use of vibration-reducing construction practices would reduce vibration levels impacts would remain **significant and unavoidable**.

5.19.5 ALTERNATIVE 7B

Alternative 7b would include the same improvements in North and Central Stockton as Alternative 7a, but would also include repairs in RD 17. The overall project length (43.2 miles) would likely affect additional noise-and vibration-sensitive receptors in RD 17, primarily in Weston Ranch, Lathrop and Manteca.

Alternative 7b would include construction activities associated with cutoff walls, seepage berms and levee widening and raises in RD 17. These would involve recurring construction activities along the entire length of the site until construction completion. On-site equipment for construction activities would include excavators, backhoes, bulldozers, scrapers, rollers, graders, loaders, compactors and trucks.

Temporary noise levels at sensitive receptors would exceed the applicable daytime standards of San Joaquin County (50 dBA L_{eq} during daytime for outdoor activity areas) and City of Stockton (55 dBA L_{eq} during daytime for outdoor activity areas), construction-related noise impacts would be significant. These short-term noise levels would result in increased annoyance and/or disrupted sleep for residential occupants and other sensitive receptors resulting in significant impacts. The use of noise-reducing construction practices would reduce noise levels but impacts would remain **significant and unavoidable**.

Vibration under Alternative 7b would affect sensitive receptors within 90 feet of project haul routes and construction boundaries and would infrequently affect the 2 sensitive receptors within 625 feet of the sheetpiling activities at Smith Canal. Vibration could exceed the FTA standard (80 VdB) for human annoyance at these receptors, although no nighttime hauling or construction activities would occur and sleep would not be disturbed. The vibration impacts associated with levee construction would result in significant impacts. The use of vibration-reducing construction practices would reduce impacts, but impacts would remain **significant and unavoidable**.

5.19.6 ALTERNATIVE 8A

Alternative 8a would include the same improvements in North and Central Stockton as Alternative 7a, but would include additional repairs along portions of Lower Calaveras River and along the Stockton Diverting Canal. Since the overall project length (34.1 miles) would be larger than Alternative 7a and smaller than Alternative 7b, Alternative 8a would likely affect more noise- sensitive and vibration-sensitive receptors than Alternative 7a and fewer than Alternative 7b.

Under Alternative 8a, temporary noise levels at noise sensitive receptors could exceed the applicable daytime standards of San Joaquin County (50 dBA L_{eq} during daytime for outdoor activity areas) and City of Stockton (55 dBA L_{eq} during daytime for outdoor activity areas), construction-related noise impacts would be significant. These short term noise levels would result in increased annoyance and/or disrupted sleep for occupants of residential dwellings and other sensitive receptors. The use of noise-reducing construction practices would reduce noise levels but impacts would remain **significant and unavoidable**.

Vibration under Alternative 8a would affect sensitive receptors within 90 feet of project haul routes and construction boundaries and would infrequently affect the sensitive receptors within 625 feet of the sheetpiling activities at Smith Canal. Vibration could exceed the FTA standard (80 VdB) for human annoyance at these receptors, although no nighttime hauling or construction activities would occur and sleep would not be disturbed. The vibration impacts associated with levee construction would thus be significant. The use of vibration-reducing construction practices would reduce levels of vibration, but impacts would remain **significant and unavoidable**.

5.19.7 ALTERNATIVE 8B

Construction of levee improvements under Alternative 8b would generate temporary, short-term and intermittent noise and vibration at or near individual noise-sensitive and vibration-sensitive locations along 53.7 miles of project reaches. Alternative 8b would include the same improvements in North and Central Stockton as Alternative 7a, except that it would include additional repairs along portions of Lower Calaveras River and along the Stockton Diverting Canal. Alternative 8b includes the same levee improvements in RD 17 as those described for Alternative 7b.

The noise and vibration impacts described for Alternative 8b are the same as those described for Alternative 7b except that additional sensitive receptors would be affected along portions of Calaveras River and the Stockton Diverting Canal. For the same reasons described for Alternative 7b, noise impacts and vibration impacts associated with levee and gate construction would be significant. The use of noise and vibration reducing construction practices would reduce noise and vibration levels, but impacts would remain **significant and unavoidable**.

Since short-term noise levels for Alternative 8b would exceed the applicable daytime standards of San Joaquin County (50 dBA L_{eq} for outdoor activity areas), City of Stockton (55 dBA L_{eq} for outdoor activity areas) and City of Manteca (50 dBA L_{eq} for outdoor activity areas), construction-related noise impacts would be significant. The use of noise-reducing construction practices would reduce noise levels, but impacts would remain **significant and unavoidable**.

5.19.8 ALTERNATIVE 9A

Construction of levee improvements under Alternative 9a would generate temporary, short-term and intermittent noise and vibration at or near individual noise- and vibration-sensitive locations along 23.6 miles of project reaches.

Alternative 9a levee improvements and gates would be the same as those proposed under Alternative 7a, except that Alternative 9a would include construction of a flood bypass in Old Mormon Slough.

Noise and vibration impacts would be the same as Alternative 7a except that there would be potential to affect additional noise- and vibration-sensitive receptors along both sides of Old Mormon Slough.

The noise and vibration impacts described for Alternative 9a are the same as Alternative 7a except that additional sensitive receptors would be affected along Old Mormon Slough. For the same reasons as Alternative 7a, noise and vibration impacts associated with levee and gate construction would be significant. The use of noise- and vibration-reducing construction practices would reduce noise and vibration levels, but impacts would remain **significant and unavoidable**.

5.19.9 ALTERNATIVE 9B

Construction of levee improvements under Alternative 9b would generate temporary, short-term and intermittent noise and vibration at or near individual noise- and vibration-sensitive locations along 43.2 miles of project reaches.

Levee improvements and gates proposed in Alternative 9b would be the same as Alternative 7b, except that Alternative 9b would include construction of a flood bypass in Old Mormon Slough. So, noise and vibration impacts would be the same as Alternative 7a except that there would be a potential to affect additional noise- and vibration-sensitive receptors along both sides of Old Mormon Slough.

For the same reasons as Alternative 7a, noise and vibration impacts from levee and gate construction would be potentially significant. The use of noise- and vibration-reducing construction practices would reduce noise and vibration levels, but impacts would remain **significant and unavoidable**.

As described for Alternative7b, vibration under Alternative 9b would affect sensitive receptors within 90 feet of project haul routes and construction boundaries and would infrequently affect the sensitive receptors within 625 feet of the sheetpiling activities at Smith Canal. Vibration could exceed the FTA standard (80 VdB) for human annoyance at these receptors. No nighttime hauling or construction activities would occur, but daytime sleep could be disturbed. The vibration impacts associated with levee construction would thus be significant. The use of vibration-reducing construction practices would reduce vibration levels, but impacts but would remain **significant and unavoidable**.

5.19.10 MITIGATION

Implementing the following mitigation measures would reduce the impact, but may not reduce noise and vibration levels at all times to a less than significant level because of the close proximity of noise-sensitive receptors to construction activities. These sensitive receptors are located along the North and Central Stockton reaches of all of the alternatives and additionally along Westin Ranch, Lathrop and Manteca in RD 17 for all of the "b" alternatives. In addition, predicted noise levels may not meet the applicable standards for local exterior noise for residential land uses and because of the limited feasibility of mitigating construction noise to acceptable levels. Therefore, these short-term impacts would be **significant and unavoidable** for all of the action alternatives (Alternatives 7a, 7b, 8a, 8b, 9a and 9b).

- The contractor shall prepare a construction noise and vibration plan prior to construction.
- The contractor shall employ vibration-reducing construction practices.
- The contractor shall employ noise-reducing construction practices.
- All construction equipment shall be equipped with noise-reduction devices such as mufflers to minimize construction noise and all internal combustion engines shall be equipped with exhaust and intake silencers in accordance with manufacturers' specifications.
- Equipment that is quieter than standard shall be used, including electrically powered equipment instead of internal combustion equipment, where use of such equipment is a readily available substitute that accomplishes project tasks in the same manner as internal combustion equipment.
- The use of bells, whistles, alarms and horns shall be restricted to safety warning purposes only.
- Noise-reducing enclosures shall be used around stationary noise-generating equipment (e.g., compressors and generators at slurry pond locations).
- Mobile and fixed construction equipment (e.g., compressors and generators), construction staging and stockpiling areas and construction vehicle routes shall be located at the most distant point feasible from noise-sensitive receptors.
- When noise-sensitive uses subject to prolonged construction noise and are located within 740 feet of construction in Stockton, Lathrop or unincorporated areas of San Joaquin county or within 1140 feet of construction in Manteca, noise attenuating buffers such as structures, truck trailers or soil piles shall be located between noise generation sources and sensitive receptors.
- Before construction activity begins within 740 feet of one or more residences or businesses (or within 1140 feet of residences or businesses in Manteca), the local sponsors (SJAFCA) shall provide written notification to the potentially affected residents or business owners, identifying the type, duration and frequency of construction activities. A noise disturbance coordinator shall be designated and contact information shall be provided in the notices and posted near the project area in a conspicuous location that it is clearly visible to nearby receptors most likely to be disturbed. The coordinator shall manage complaints and concerns resulting from noise-generating activities. The severity of the noise concern would be assessed by the coordinator and if necessary, evaluated by a qualified noise control engineer.
- The project proponent (USACE, CVFPB and/or SJAFCA) shall ensure that all heavy trucks are properly maintained and equipped with noise control (e.g., muffler) devices in accordance with manufacturers' specifications at each work site during project construction to minimize construction traffic noise effects on sensitive receptors.
- Before haul truck trips are initiated during construction season on roads within 90 feet of residences located along haul routes, written notification shall be provided to potentially affected residents identifying the hours and frequency of haul truck trips. Notifications provide contact information for a noise disturbance coordinator identified above and also identify a mechanism for residents to register complaints with the appropriate jurisdiction if haul truck noise levels are overly intrusive or occur outside the exempt daytime hours for the applicable jurisdiction.

5.20 PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS

This section describes the affected environment and environmental consequences relating to hazardous, toxic and radiological materials and waste for the LSJR project. For the purposed of this section, the term "hazardous materials" refers to both hazardous substances and hazardous wastes. A hazardous material is defined as "a substance or material that is capable of posing an unreasonable risk to health, safety and property when transported in commerce" (49 CFR Section 171.8). California Health and Safety Code Section 25501 defines a hazardous material as follows:

"Hazardous material" means any material that, because of its quantity, concentration or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. "Hazardous materials" include, but are not limited to, hazardous substances, hazardous waste and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.

Hazardous wastes are defined in California Health and Safety Code Section 25141(b) as wastes that:

...because of their quantity, concentration or physical, chemical or infectious characteristics, [may either] cause or significantly contribute to an increase in mortality or an increase in serious illness[or] pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed.

5.20.1 ENVIRONMENTAL SETTING

Regulatory Framework

The principal Federal regulatory agency responsible for the safe use and handling of hazardous materials is the EPA. Key Federal statutes pertaining to hazardous wastes are listed below. Other applicable Federal regulations are contained primarily in CFR Titles 29, 40 and 49.

Federal

- Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §9601, *et seq.*
- Hazardous Materials Regulations (Title 49 CFR, Parts 100-185) (rail transport)
- Resource Conservation and Recovery Act, 42 U.S.C. §6901, *et seq.*
- Worker Safety Requirements

State

- Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying and Surface Mining Operations
- California Emergency Response Plan (Governor's Office of Emergency Services)
- Emergency Services Act
- Hazardous Materials Release Response Plans and Inventory Act of 1985
- Hazardous Waste Control Act
- Health and Safety Code, Division 20, Chapter 6.95, Article 1)
- Worker Safety Requirements (Title 8 California Code of Regulations (CCR))

Local

- City of Lathrop General Plan (2004) (Goal 4, Policies 4 and 6)
- City of Manteca General Plan (2003) (Goal S-5, Policies S-P-15, S-P-16, S-P-17; Goal S-6)
- City of Stockton General Plan (2007)
- San Joaquin County General Plan (Policies 1, 2 and 4)

Existing Conditions

A Hazardous, Toxic and Radioactive Waste (HTRW) Summary Report (USACE, 2014) was completed for all areas where construction work could occur under any of the action alternatives. A Phase I Environmental Site Assessment of Old Mormon Slough was also completed (Kleinfelder, 2013). The assessment consisted of a records investigation, interviews and site reconnaissance and focused on the Old Mormon Slough between the Stockton Diverting Canal and the Stockton Deep Water Ship Channel. The HTRW Summary Report consisted of a records and literature review focused on the construction footprint and the area immediately adjacent for all of the LSJR action alternatives. The area of HTRW study for this summary report was defined as buffer areas within 0.25 miles along 40 miles of the proposed levees identified in Alternatives 7a, 7b, 8a, 8b, 9a and 9b excluding the Old Mormon Slough (see Chapter 3, Figures 3-12 and 3-13 [Alternatives 9a and 9b] for the location of Mormon Slough). The levees are located near the city of Stockton, San Joaquin County, California.

There are 40 Underground Storage Tank (UST) sites in northeast and northwest Stockton sections and 20 known Leaking Underground Storage Tanks (LUST) in both sections. The EPA's Emergency Response Notification System (ERNS) records show incidents of releases of oil and hazardous substances. There are a large number of such incidents throughout the HTRW area of study, especially in northeast and northwest Stockton. Several of the sites referred to the Regional Water Quality Control Board are likely to contain contaminated groundwater on-site and potentially off-site. These groundwater HTRW sites could affect worker safety, dewatering operations or excavation work depending on the depth to groundwater and magnitude of the groundwater plumes. Out of the 61 sites in the HTRW study area listed in the GeoTracker

website, 36 are in the "Completed – Case Closed" status and the majority of those open sites are undergoing remediation or being assessed by California Water Board.

Overall, the EnviroStor website showed a total of 22 hazardous waste and clean-up sites in the HTRW study area. These sites are present in all of the alternatives. The sites were primarily chemical companies and petroleum companies all located in northeast and northwest Stockton. Out of the 22 sites, 8 of them were in "No Further Action" status and the rest were either open or referred to other agencies. In addition to the hazardous materials described above, buildings and other infrastructure in the project area may include component materials that are hazardous, such as lead paint or asbestos.

5.20.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

Regulatory database search reports and regulatory agencies' websites were reviewed and assessed for HTRW sites in the study area. For the purposes of the HTRW analysis, the study area was defined as buffered areas within 0.25 miles along 40 miles of the proposed levees identified in Alternatives 7a, 7b, 8a, 8b, 9a and 9b that are located in northeast, northwest and south Stockton.

In order to identify HTRW sites in the study area, USACE:

- Reviewed Federal, State and local environmental databases;
- Reviewed hazardous waste sites and clean-up sites in EnviroStor of California (CA) Department of Toxic Substances Control (DTSC) and GeoTracker of CA State Water Resources Control Board and;
- Reviewed information about Naturally Occurring Asbestos in the CA Department of Conservation website.

The following sources were reviewed for HTRW sites in the HTRW Study Area (Fig 2).

- Environmental Data Resources (EDR) Database Search Reports (in Attachments 1-6)
- EnviroStor website (http://www.envirostor.dtsc.ca.gov/public)
- GeoTracker web site (http://geotracker.waterboards.ca.gov)
- Department of Conservation (http://www.conservation.ca.gov/cgs/minerals/hazardous_minerals/asbestos/Pages/index.aspx)

Basis of Significance

The thresholds for determining the significance of impacts for this analysis are based on the environmental checklist in Appendix G of the State CEQA Guidelines. These thresholds also encompass the factors taken into account under NEPA to determine the significance of an action in terms of its context and the intensity of its impacts. The alternatives under consideration were determined to result in a significant impact related to hazards and hazardous materials if they would do any of the following:

- Create a significant hazard to the public or the environment through the routine transport use or disposal of hazardous materials or through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Emit hazardous emissions or involve the handling of hazardous or acutely hazardous materials, substances or waste within one-quarter mile of an existing or proposed school.
- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to California Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment (Health & Safety Code § 65962.5).

5.20.3 ALTERNATIVE 1 - NO ACTION

Under the No Action Alternative, the levee improvement project would not be constructed, therefore, there would be no construction-related effects from HTRW (e.g. accidental spills of hazardous materials) in the project area. However, the existing flood risk would continue, which could potentially lead to significant flooding and levee failures in a future flood event.

Without levee improvements, there is the continued high risk of levee failure and continuing under seepage and loss of levee foundation soils. If a levee overtopping or breach were to occur, flood fighting and other emergency response activities would occur. Flood waters could release contaminants from buildings and other infrastructure (e.g., lead paint and asbestos), stored chemicals, septic systems and flooded vehicles, all of which could contaminate the SJR, the Calaveras River, French Camp Slough and Delta sloughs, as well as soil and groundwater in the project area. These contaminants would likely exceed acceptable established water quality standards and impair beneficial uses of the river, its tributaries and sloughs in project area, including downstream drinking water intakes. Effects on the water supply system could be particularly severe in a flood event, as a single break in a water delivery pipe or main could contaminate the entire city's water supply. All breaks and leaks would need to be repaired and the pipes of every house would need to be flushed to remove contamination before residents and businesses could rely on safe water. Depending on the severity and location of the flooding and contamination, this effort could take a significant amount of time.

Flood damage to homes and other structures can render them dangerous due to structural damage and contamination. Electrical systems could be damaged by flooding, posing potential fires and natural gas leaks that could result in poisoning through inhalation of fumes or could cause a sudden explosion if sparked. The likelihood of a significant amount of mold production is high after a flood event. Mold not only threatens the physical integrity of structures, but also poses its own health risks. Mold can cause lung infections, skin irritations and other health dangers, especially for those with asthma, allergies or suppressed immune systems. Additionally, the floodwaters themselves and ponds left behind, could provide a wide breeding ground for mosquitoes and the incidence of West Nile Virus and other diseases would likely increase. The magnitude of the impacts described above would depend upon the location of the levee breach, severity of the storm and river flows at the time of flooding. Predicting these events and providing a determination of significance is not possible based on available information. Thus, identification of potential effects from levee failure is **too speculative for meaningful consideration**.

Under the No Action Alternative, regular O&M of the levee system would continue as presently executed by the local maintaining entities (subject to revision of the governing O&M manual). Such activities include hand and mechanical (mower) removal of weeds, spraying of weeds with approved pesticides, minimal tree or shrub trimming up to four times a year, monthly control of burrowing rodent activity by baiting with pesticide and reconditioning of levee slope and road as needed. Normal O&M activities would be short-term and small scale; thus, impacts from HTRW from continued O&M activities would be **less than significant**.

5.20.4 ALTERNATIVE 7A

Construction activities for Alternative 7a would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles such as excavators, compactors, haul trucks and loaders. In some parts of the project area, these materials would be used or transported within one quarter mile of an existing school. Construction contractors would be required to use, store and transport hazardous materials in compliance with Federal, State and local regulations during project construction and operation. However, fuels and lubricants could be accidentally released into the environment at the construction site and along haul routes, causing environmental or human exposure to these hazards.

The implementation of environmental commitments, including SWPPP, BSSCP, SPCCP and the implementation of avoidance, minimization and mitigation measures, would ensure minimal risk of accidental spills and releases into the environment. Any hazardous substance encountered during construction would be removed and properly disposed of by a licensed contractor in accordance with Federal, State and local regulations. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities.

There is the potential that known or previously undocumented hazardous materials could be encountered at project sites. Where buildings or other infrastructure must be moved or removed, there would be a potential for exposure to hazards, such as lead paint and asbestos. Excavation and construction activities at or near areas of currently unrecorded soil or groundwater contamination could result in the exposure of construction workers, the general public and the environment to hazardous materials such as petroleum hydrocarbons, pesticides, herbicides, fertilizers, contaminated debris or elevated levels of other chemicals that could be hazardous. There are known sites within the project area that contain hazardous materials. All known HTRW sites are required to be remediated in accordance with Federal, State and local laws by the non-Federal sponsor prior to project construction. No construction activities would occur in proximity to these sites until they have been completely remediated and meet all regulatory requirements. Construction activities in the vicinity of known or potentially unknown, recognized environmental concerns could result in public health hazards if they are not properly addressed prior to construction.

Implementation of Alternative 7a would result in post-construction O&M activities conducted per the approved USACE O&M manual applicable to this reach. Such activities include hand and mechanical (mower) removal of weeds, spraying of weeds with approved pesticides, minimal tree or shrub trimming up to four times a year, monthly control of burrowing rodent activity by baiting with pesticide and reconditioning of levee slope and road with a bull dozer as needed. Normal O&M activities would be short-term and small scale; therefore, impacts to HTRW would be **less than significant**.

The risk of incidental release of hazardous materials during their transport and use in project construction activities is low. Because normal O&M activities would be short-term and small scale and with implementation of avoidance, minimization and mitigation measures, impacts from construction activities in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant**.

5.20.5 ALTERNATIVE 7B

Alternative 7b includes all of the same sites as Alternative 7a, but differs because it also includes RD 17. Alternative 7b construction activities would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles. In some parts of the project area, these materials would be used or transported within 0.25 mile of an existing school. These potential impacts and regulation requirements are described under Alternative 7a. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction.

The risk of incidental release of hazardous materials during their transport and use in project construction activities is low and because normal O&M activities would be short term and small scale and with the implementation of avoidance, minimization and mitigation measures, impacts from construction activities in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant** levels.

5.20.6 ALTERNATIVE 8A

Alternative 8a includes all of the same sites as Alternative 7a, but differs in Central Stockton where additional levee improvements are proposed on the Lower Calaveras River and the Stockton Diverting Canal. Construction activities for Alternative 8a would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles. In some parts of the project area, these materials would be used or transported within 0.25 mile of an existing school. These potential impacts are described under Alternative 7a. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities.

The risk of incidental release of hazardous materials during their transport and use in project construction activities is low and because normal O&M activities would be short-term and small scale and with the implementation of avoidance, minimization and mitigation measures, impacts from construction in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant** levels.

5.20.7 ALTERNATIVE 8B

Alternative 8b includes all of the same sites as Alternative 7b, but differs in Central Stockton where additional levee improvements are proposed on the Lower Calaveras River and the Stockton Diverting Canal. Construction activities for Alternative 8b would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles. In some parts of the project area, these materials would be used or transported within 0.25 mile of an existing school. These potential impacts are described under Alternative 7a. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction.

The risk of incidental release of hazardous materials during their transport and use in project construction activities is low and because normal O&M activities would be short term and small scale and with the implementation of avoidance, minimization and mitigation measures, impacts from construction activities in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant** levels.

5.20.8 ALTERNATIVE 9A

Alternative 9a includes the same sites as Alternative 7a, but differs in the addition of a flood bypass that would divert floodflows from the Stockton Diverting Canal into and through the Mormon Channel Bypass. Construction activities would involve the use of hazardous materials such as fuels and lubricants to operate

construction equipment and vehicles. In some parts of the project area, these materials would be used or transported within 0.25 mile of an existing school. These potential impacts are described under Alternative 7a. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities.

The risk of incidental release of hazardous materials during their transport and use in project construction activities is low and because normal O&M activities would be short term and small scale and with the implementation of avoidance, minimization and mitigation measures, impacts from construction activities in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant** levels.

5.20.9 ALTERNATIVE 9B

Alternative 9b includes the same sites as Alternative 7b, but differs in the addition of a flood bypass that would divert floodflows from the Stockton Diverting Canal into and through the Mormon Channel Bypass. Construction activities would involve the use of hazardous materials such as fuels and lubricants to operate construction equipment and vehicles. In some parts of the project area, these materials would be used or transported within 0.25 mile of an existing school. These potential impacts are described under Alternative 7a. Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during transport and construction activities.

The risk of incidental release of hazardous materials during their transport and use in construction is low and because normal O&M activities would be short-term and small scale and with the implementation of avoidance, minimization and mitigation measures, impacts from construction activities in the vicinity of known or potentially unknown recognized environmental concerns would reduce impacts to **less than significant** levels.

5.20.10 MITIGATION

Each of the action alternatives involve the transport and use of hazardous materials. These are materials commonly used in construction of levees and associated infrastructure. Parts of each action alternative are within 0.25 mile of 1 or more schools. The project partners and their construction contractor would work with local schools prior to beginning construction to ensure that all appropriate measures are in place to reduce risk to schools, students, teachers and other employees and maintain less than significant impacts from hazardous emissions and transport and use of hazardous materials.

Alternatives 7a, 7b, 8a, 8b, 9a and 9b all occur on or in close proximity to, hazardous material sites, possessing the potential to cause hazards to construction workers and the public. These alternatives all include the potential for encountering hazardous materials, such as lead paint and asbestos) during removal or relocation of buildings and other infrastructure. Project areas would be tested for contaminants prior to construction and any materials found would be disposed of in accordance with all Federal, State and local regulations at an approved disposal site. Implementation of these mitigation measures would reduce the impacts from hazardous materials at project sites to **less than significant**.

If significant time has elapsed between approval of this document and construction, additional investigations should be done to reduce risk. If construction activities would occur in close proximity to sites identified in the existing conditions section or in the Phase I Site Assessment, a Phase II Environmental Site Assessment should also be conducted. This would further reduce the risk of exposure to workers and the public during construction and assist in the remediation planning. If necessary, the assessment would include an analysis of soil or groundwater samples for the potential contamination sites that have not yet been covered by previous investigations before construction activities begin.

Recommendations in Phase I and Phase II Environmental Site Assessments to address any contamination that is found would be implemented before initiating ground-disturbing activities. In addition, the following measures would be implemented before ground-disturbing or demolition activities begin, in order to reduce health hazards associated with potential exposure to hazardous substances:

- Complete a Phase I Site Assessment prior to completing preconstruction designs and initiating construction.
- Prepare a site plan that identifies any necessary remediation activities appropriate for proposed land uses, including excavation and removal of contaminated soils and redistribution of clean fill material on the project site. The plan would include measures that ensure the safe transport, use and disposal of contaminated soil and building debris removed from the site, as well as any other hazardous materials. In the event that contaminated groundwater is encountered during site excavation activities, the contractor would report the contamination to the appropriate regulatory agencies, dewater the excavated area and treat the contaminated groundwater to remove contaminants before discharge into the sanitary sewer system. The contractor would be required to comply with the plan and applicable Federal, State and local laws.
- Notify appropriate Federal, State and local agencies if evidence of previously undiscovered soil or groundwater contamination is encountered during construction. Any contaminated areas would be cleaned up in accordance with the recommendations of the Central Valley RWQCB, California DTSC or other appropriate Federal, State or local regulatory agencies.
- A worker health and safety plan would be prepared before the start of construction that identifies, at a minimum, all contaminants that could be encountered during construction; all appropriate worker, public health and environmental protection equipment and procedures to be used during project activities; emergency response procedures; the most direct route to the nearest hospitals; and a Site Safety Officer. The plan would describe actions to be taken if hazardous materials are encountered on-site, including protocols for handling hazardous materials, preventing their spread and emergency procedures to be taken in the event of a spill.
- Retain licensed contractors to remove all underground storage tanks.

5.21 CULTURAL RESOURCES

This chapter describes the environmental setting associated with cultural resources, assesses the effects to cultural resources that would result from implementation of the proposed action and presents mitigation measures that would reduce these effects to less than significant. The key sources of data and information used in the preparation of this chapter are listed below.

- Review of existing information.
- Consultation with interested parties.
- Archival research.
- Reconnaissance surveys of selected previously recorded cultural resources.

Cultural resources are defined in this chapter as prehistoric and historic archaeological sites, the historic built environment and traditional cultural properties.

5.21.1 ENVIRONMENTAL SETTING

Regulatory Framework

Federal

National Historic Preservation Act

The proposed project would require that USACE comply with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) and its implementing regulations (36 CFR 800, Section 106). Section 106 requires that, before beginning any undertaking, a Federal agency must take into account the effects of the undertaking on historic properties (cultural resources listed or eligible for listing on the National Register of Historic Places [NRHP]) and afford the Advisory Council on Historic Preservation an opportunity to comment on these actions. Federal agencies may comply with Section 106 by either completing the management steps indicated in the regulations (36 CFR Part 800) or preparing an agreement document that describes the particular process an agency will use to complete the same steps for a specific set of undertakings.

Cultural resources are eligible for the NRHP if they have integrity and significance as defined in the regulations for the NRHP. Four primary criteria define significance; a property may be significant if it displays 1 or more of the characteristics (36 CFR 60.4). (Criterion A) It is associated with events that made a significant contribution to the broad patterns of our history; (Criterion B) is associated with the lives of people significant in our past; (Criterion C) embodies the distinct characteristics of a type, period or method of construction or that represents the work of a master or that possesses high artistic values or represents a significant and distinguishable entity whose components may lack individual distinction; or (Criterion D) it has yielded or is likely to yield, information important in prehistory or history.

Some types of cultural resources are not typically eligible for the NRHP. These resources consist of cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature and properties that have achieved significance within the past 50 years. These property types may be eligible for the NRHP, however, if they are integral parts of eligible districts of resources or meet the criteria considerations described in 36 CFR 60.4.

In addition to possessing significance, a property must also have integrity to be eligible for listing in the NRHP. The principle of integrity has seven aspects: location, design, setting, materials, workmanship, feeling and association (36 CFR 60.4). To retain historic integrity, a property needs to possess several and usually most, of these aspects (National Park Service, 2002). The evaluation of a resource's integrity in relation to its significance will be conducted as prescribed in National Register Bulletin No. 15: How to Apply the National Register Criteria for Evaluation (National Park Service, 2002).

The Section 106 review process typically consists of the following major steps:

- Identify the Federal agency undertaking.
- Identify the area of potential effects.
- Initiate Section 106 process.
- Identify historic properties.
- Evaluate effects to historic properties.
- Resolve adverse effects.

State

Under CEQA, a cultural resource is considered important if it meets the definition of "historical resource or unique archaeological resource." Public Resource Code (PRC) Section 5020.1(j)) states:

"Historical resource" includes, but is not limited to, any object, building, structure, site, area, place, record or manuscript which is historically or archaeologically significant or is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military or cultural annals of California. Historical resources may be designated as such through 3 different processes.

Official designation or recognition by a local government pursuant to local ordinance or resolution (PRC Section 5020.1(k)). A local survey conducted pursuant to PRC Section 5024.1(g). Listed in or eligible for listing in the NRHP (PRC Section 5024.1(d)(1). The process for identifying historical resources typically is accomplished by applying the criteria for listing in the CRHR (14 CCR 4852), which states that a historical resource must be significant at the local, state or national level under one or more of the four criteria. (Criterion 1) It is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage. (Criterion 2) It is associated with the lives of persons important in our past. (Criterion 3) It embodies the distinctive characteristics of a type, period, region or method of construction or represents the work of a master or possesses high artistic values. (Criterion 4) It has yielded or may be likely to yield, information important in prehistory or history.

To be considered an "historical resource" for the purpose of CEQA, the resource must also have integrity, which is the authenticity of a resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Resources, therefore, must retain enough of their historic character or appearance to be recognizable as historical resources and to convey the reasons for their significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling and association. It also must be judged with reference to the particular criteria under which a resource is eligible for listing in the CRHR (14 CCR 4852[c]).

The State also recognizes the importance of "unique archaeological resources" defined in PRC Section 21083.2 as an archaeological artifact, object or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria.

- Contains information needed to answer important scientific research questions and for which there is a demonstrable public interest.
- Has a special and particular quality such as being the oldest of its type or the best available example of its type.
- Is directly associated with a scientifically recognized important prehistoric or historic event or person.

In most situations, resources that meet the definition of a unique archaeological resource also meet the definition of historical resource. As a result, it is current professional practice to evaluate cultural resources on their eligibility for listing in the CRHR. For the purposes of this cultural resources study, a resource is considered important if it meets the CRHR eligibility (significance and integrity) criteria.

Existing Conditions

Cultural History

This section provides an overview of the context and chronology of the human use of the LSJR Basin and the Stockton region. Portions of this section were excerpted from Rosenthal and Whittaker (2009), AECOM (2010) and Jones, Bartoy, Blind and Holson (2006).

Prehistoric Setting

The complexity of the archaeological record in the central California Delta region has resulted in the development and refinement of local sequences with specific cultural traits and chronologies (Hughes, 1994). Fredrickson (1974) proposed a tripartite scheme - Archaic, Emergent and Ethnographic - each with subdivisions, appropriate characteristics and chronological ranges. The Lower Archaic (10,000-6000 B.P.) and the Initial Middle Archaic (6000-4500 B.P.) are not well known from San Joaquin County and are primarily represented from the research completed at Los Vaqueros Reservoir to the southwest (Meyer and Rosenthal, 1997). The other divisions of the Archaic, Emergent and Ethnographic are reasonably well represented in the central Delta area. Additional details on the chronology and characteristics of these cultural divisions are presented in Fredrickson (1994a-b) and summarized below.

The Terminal Archaic period is noted as having side-notched and stemmed projectile points, rectangular abalone ornaments, shaped and unshaped mortars and pestles and rectangular Olivella shell beads (Fredrickson, 1966). Subsistence focused on nuts and berries as well as bay-shore resources (shellfish, marine fishes and mammals), freshwater fish, shellfish and terrestrial mammals (Banks and Orlins, 1985; Simons, 1992).

Upper Archaic sites are characterized by a bone tool and ornament industry and unshaped and well-shaped mortars and pestles. Subsistence was still centered on nuts and seeds and faunal assemblages indicate an inclusion of marine and/or mammal resources (Broughton, 1997; Fredrickson, 1968). The presence of ocean shellfish in the archaeological record indicates a growing reliance on marine resources in interior valley sites (Fredrickson, 1968).

The Meganos Culture began to appear in the San Joaquin Valley and Delta during the Upper Archaic. It spread quickly into Contra Costa County and other parts of the Bay Area (Bennyhoff, 1968; Bennyhoff and Hughes, 1987). The Meganos Culture has been characterized as a blend of bay and Delta populations.

The time period between 1300 B.P. and 1100 B.P. was one of social change and upheaval in the Delta and Central Valley. The southern Wintuan groups (ancestral Patwin) pushed the Meganos peoples into the Sacramento Delta and the Bay Miwok groups from the West Delta to Suisan Bay (Bennyhoff, 1994b). Costanoan groups began to move across the Carquinez Strait. Meganos cemeteries in the Alameda and Diablo districts were abandoned during this turbulent 200 year period (see Bennyhoff, 1994a-c). After 900 B.P., the Meganos peoples integrated with the Valley Yokuts groups in the San Joaquin Valley (Bennyhoff, 1994c).

During the Emergent Period, cremations became quite common and the bow and arrow were introduced with the concomitant use of small projectile points (Moratto, 1984; Schenck and Dawson, 1929). Bedrock mortar milling stations appear early in the Emergent Period and were used in association with other portable milling equipment. Nuts, berries and seeds were collected and processed. Large terrestrial mammals (e.g., deer, elk) appear to have been favored. Marine shellfish and marine fishes appear inland in much larger quantities than in previous periods (Fredrickson, 1968). Emergent Period sites, typically identified as large mound villages, are found every few miles along the SJR and its major tributaries.

Ethnographic Setting

The Northern Valley Yokuts occupied the land on each side of the SJR from the Delta to south of Mendota when first encountered by the Spanish. The Yokuts' occupation of the northern parts of the Diablo range may be relatively recent, as linguistic evidence points toward an earlier Miwok occupation. The late prehistoric Yokuts were probably the largest indigenous culture in pre-contact California.

European contact with the Northern Valley Yokuts began with intermittent trips by Spanish explorers traveling through the Sacramento–San Joaquin Valley in the late 1700s and early 1800s. Missionaries lured or captured many Yokuts and kept them in various missions, although many escaped and returned home to the valley. Skirmishes between Yokut raiding parties and the Spanish and other Euroamericans resulted from repeated cattle rustling, which ultimately lead to the deaths of numerous Yokut individuals. A malaria epidemic in 1833 greatly diminished the Native population by killing thousands of Yokuts and people of surrounding groups. The local population was further reduced by the rapid appearance of miners during the Gold Rush era. Despite the fact that there was no gold in the Yokuts' territory, miners making their way to the gold fields caused upheaval. The remaining native populations were later displaced by miners, who returned to farm the area (Wallace, 1978).

Historic-Era Setting

Spanish missionaries were among the first recorded European visitors to the study area (Bakic and Lewiston, 1999). In 1776, Juan Batista de Anza, along with Friar Pedro Font, traveled south along a portion of the SJR with a party of immigrants from Monterey (Beck and Haase, 1974). Other eighteenth-century explorers of the area included Pedro Fages (1772) and Francisco Eliza (1793). Nearly 30 years later, Moraga completed more intensive explorations into the area, exploring some distance up and down the Mokelumne and Cosumnes rivers (Beck and Haase, 1974).

The establishment of the Spanish mission system ensured strong Hispanic influence throughout early California. Mexican influences remained even after the succession of Alta California to the U.S. in 1848 (Beck and Hasse, 1974). Hispanic relations with Native Americans were strained as demonstrated by the Stanislaus War fought in southern San Joaquin County beginning in 1828 (Keefe, 2004).

The first Euroamerican to traverse the area was probably Jedediah Strong Smith, who opened the Sacramento Trail in the late 1820s (Jones and Stokes, 2004). In 1832, French-Canadian hunters and an assemblage of travelers from Jedediah Smith's party, Peter Ogden's party and Ewing Young's party first occupied the area known as French Camp, four miles south of present-day Stockton. The hunters were employed by the Hudson's Bay Company to trap beaver, mink, bear and other fur-bearing animals.

Rancho del Campo de los Franceses, was established for the French-Canadian fur trappers of the Hudson's Bay Company. Charles M. Weber, a native of Germany, traveled to French Camp on his way into California with the Bidwell-Bartleson party in the fall of 1841 (Hoover et al., 1990). Weber eventually settled in Pueblo de San José and went into partnership with William Gulnac, a blacksmith. In 1844, Gulnac received a large land grant, which included both French Camp and the site of the present-day Stockton. Gulnac and

Weber organized a company of 12 men for the purpose of forming a colony at French Camp, which was the first colony of white settlers to settle land in the San Joaquin Valley (Hoover et al., 1990).

The city of Stockton first started when Weber turned his strategy from gold mining, in late 1848, to supplying gold-seekers. To this end, he took over Gulnac's portion of their joint Spanish land grant (Rancho del Campo de los Franceses) in 1849 (City of Stockton, 2011; Schlichtmann and Paden, 1986). The area currently known as Weber Point is the location of his first permanent residence in Stockton. Stockton was named by Weber in honor of Commodore Robert F. Stockton, although he later regretted it (Tinkham 1880).

Stockton was incorporated on July 23, 1850 by the County Court and the first city election was held on July 31, 1850 (City of Stockton, 2011). Stockton received its charter from the State of California in 1851. Early settlers of Stockton resembled those of other California settlements and included gold seekers from Asia, Africa, Australia, Europe, the Pacific Islands, Mexico and Canada (City of Stockton, 2011).

The Port of Stockton was the first and is still the largest, inland seaport in California. The first cargo boat traversed the San Joaquin in 1846. Two years later, in 1848, the first ferry service was established and the first freight vessel visited Stockton (Tinkham, 1880; Port of Stockton, 2014). During the 1850s, the port had become a center of commodity shipping and the supply center for the southern goldfields with 2000 to 3000 people landing in April of 1850 on the way to the gold fields (Schlichtmann and Paden, 1986; Tinkham, 1880). Supplies would be unloaded at Stockton and then either ported via stage, wagon and eventually train to the southern mines (Schlichtmann and Paden, 1986).

By the 1860s, gold production was declining while agriculture was increasing in the region. From 1890 to 1920, Stockton was a very active port city. Grain was the major cargo for the ocean vessels that visited the port (McElhiney, 1992). Due to the export of farming commodities, Stockton grew into a major commercial center. By the late 1880s, it was a highly industrialized California city, second only to San Francisco (McElhiney, 1992). The Stockton Deep Water Ship Channel was completed and the Port of Stockton was modernized in 1933. Across the river from the Port of Stockton is Rough and Ready Island, which was developed into a U.S. Naval Supply Base during World War II and was important in the development of modern supply and transport methods. Shipping remains important to Stockton today.

The City of Stockton sits along the southeastern edge of the Delta and important historical themes from the Delta are mirrored in the development of the Stockton Area including agriculture, irrigation and reclamation. Early farming consisted primarily of subsistence gardening during and following the Gold Rush, but the growth of the agricultural industry in the Delta was steady and by late 1870s, market gardens near Stockton were developing into formidable competitors for the San Francisco produce trade, which was dominated by Santa Clara Valley and bay area locations. By 1883, large amounts of garden vegetables were being shipped to San Francisco after the daily harvest was picked up by river steam ships. Thompson (1957) noted that the transition of the Delta region from garden to field agriculture occurred in the 20th century. With the advent of electric pumps in 1905 and 1906, the previously used steam-powered and horse-powered devices were largely abandoned.

Large-scale irrigation was initially delivered through tidal gates and drainage ditches. Irrigation in the lower Delta relied on siphons and gravity flow while water wheels, windmills and low-head pumps were used on higher alluvial tracts. Irrigation in the Delta did not reach its full fluorescence until 1898 when the levee around the Moss Tract was breached to admit water and a steamer pumped water onto Rough and Ready Island (Thompson, 1957).

Settlements in the Delta were initially situated on naturally formed levees created by the merging of floodplains and tidal environments and consisted of single-family farms and farm labor camps. However, in the central Delta, sediments consisted primarily of peat and the natural levees were poorly developed. The first levees in this area were built by crews of Chinese laborers using only shovels and wheelbarrows.

After the development of a clamshell dredger in the late 1800s, larger, more stable levees were constructed and agriculture expanded (McElhiney, 1992). The early levees and even later structures built in the 1860s and 1870s rarely remained intact for more than 1 or 2 years and required frequent repairs and upgrades. Dredges were being widely used by 1870 and allowed for the use of a wider variety of fill materials, such as clay from the channel floors, in levee construction. In addition to these themes, the city of Stockton also underwent significant urban development within and adjacent to the study area. This was highly dependent on the development of shipping capacities at the Port of Stockton.

Methods for Identification

This study was limited to a record search and reconnaissance site visits to recorded sites within 1000 feet of the alignments in the northern portion of the study area, excluding the elements associated with Old Mormon Slough and RD 17. A small segment (2700 feet) along Duck Creek was identified as part of the study area after the record search was completed, but will be included during future studies in accordance with the PA. The record search was completed in April 2014. The site locations were then digitized and reconnaissance site visits were performed for a selection of those sites, including both prehistoric and historic sites. Sites visited were selected based on these factors:

- Age
- Site Type
- Accessibility
- Eligibility

An attempt to visit the locations of all prehistoric sites was made; however, certain prehistoric site locations were not accessible at the time of the field visit. Other site types targeted include historic buildings and structures and historic archaeological sites. Sites excluded from selection include historic linear alignments such as levees, roads and railroads, given their consistent appearance. Additionally, no attempt to visit structures associated with the Naval Supply Annex Stockton Historic District (NSAS-HD) located on Rough and Ready Island, was made as these buildings have previously been found eligible for the register and mitigation completed in the form of a Historic American Building Survey (HABS). Photographs of the Rough and Ready Island waterfront along the project corridor were taken. Because rights of entry were not available for the properties, all observations were made from the crown of the levee. A total of six cultural resources within Alternative 7A (Recommended Plan) were visited on April 24, 2014 and were completed by Nikki Polson, M.A., USACE Archaeologist and Stefanie Adams, USACE Cultural Resources Staff (Polson and Perry, 2014). Sites visited are noted in Table 5-44. Additional surveys and other necessary work will be completed as per the PA.

Known Cultural Resources

A total of 32 previously conducted archaeological investigations occurred within the Alternative 7a (RP) study area. This includes archaeological surveys, test excavations, data recovery projects and other investigations. At least 30 cultural resources were previously recorded in the Alternative 7a (RP) study area. In addition to these resources, an isolated Native American burial was removed; 8 historic structures are listed, but not mapped in the Historic Property Data File; and 8 additional bridges were identified in the Caltrans Bridge Inventory within the study area. Cultural resources within or adjacent to the study area include prehistoric sites, levees, water conveyance structures, railroads, bridges and historic structures. A portion of the Naval Supply Annex Stockton Historic District (NSAS-HD) is located within the study area. Any resources associated with the district are discussed as part of the district, even if they would otherwise qualify under another category. In some cases, the eligibility of cultural resources within Alternative 7a

(RP) was determined. Consultation concerning the eligibility of cultural resources for the NRHP and effects to historic properties will occur as stipulated in the PA. All recorded sites are summarized in Table 5-44.

Prehistoric Sites

A total of 3 prehistoric sites were previously recorded within the study area. Each was recorded as an occupation site and most are known to contain or have once contained human remains. There is an additional known unrecorded site that will be investigated. Based on visits to 2 of the 4 sites and previous site recordation, the overall integrity of these sites is highly suspect as all were subject to disturbance through some degree of modern development, including development of subdivisions and a gravel pit. Because of the nature of these sites, it is likely that additional prehistoric cultural resources and burials will be discovered during project implementation.

Table 5-44: Recorded Cultural Resources within Alternative 7a (RP)

Site Number	Site Type/Name	Site Age	Visited Yes/No	Eligibility
P-39-0112	Atchison, Topeka and Santa Fe Railroad	Historic	No	Not Determined
P-39-0220	Occupation Site	Prehistoric	Yes	Not Determined
P-39-0237	Occupation Site	Prehistoric	Yes	Not Determined
P-39-0244	Bear Creek	Prehistoric	No	Not Determined
P-39-0425	Entry Gate, NSAS-HD	Historic	No	Contributing Element, Mitigated
P-39-0427	Marginal Wharf, NSAS-HD	Historic	No	Contributing Element, Mitigated
P-39-2513	Bridge	Historic	No	Not Eligible
P-39-2824	Bridge, NSAS-HD	Historic	No	Contributing Element, Mitigated
P-39-2864	Railroad, NSAS-HD	Historic	No	Contributing Element, Mitigated
P-39-2865	Railroad Bridge, NSAS-HD	Historic	No	Contributing Element, Mitigated
P-39-4269	House	Historic	No	Recommended Not Eligible
P-39-4270	House	Historic	No	Not Determined
P-39-4399	Mokelumne Aqueduct	Historic	Yes	Recommended Eligible
P-39-4516	Levee	Historic	No	Not Determined
P-39-4517	Levee	Historic	No	Not Determined
P-39-4576	Naval Supply Annex Stockton Historic District	Historic	Yes	Eligible, Mitigated
P-39-4854	Central United Methodist Church	Historic	Yes	Recommended Eligible
P-39-4917	Shima Tract Levee	Historic	No	Not Determined
P-39-4918	Mosher Slough Levees	Historic	No	Not Determined
P-39-4922	Brookside Levee	Historic	No	Not Determined
P-39-5152	Burns Cutoff Levee (Left Bank)	Historic	No	Recommended Not Eligible
NA	Unrecorded Burial	Prehistoric	No	Not Determined
Unrecorded Section of P-39-00098	Union Pacific Railroad	Historic	No	Not Determined
NA	Unrecorded Railroad Spur	Historic	Yes	Not Determined
	Bridge 29C-058	Historic	No	Not Eligible
	Bridge 29C-096	Historic	No	Not Eligible
	Bridge 29C-134	Historic	No	Not Eligible
	Bridge 29C-140	Historic	No	Not Eligible
	Bridge 29C-141	Historic	No	Not Eligible
	Bridge 29C-239	Historic	No	Not Eligible
	Bridge 29C-240	Historic	No	Not Eligible
	Bridge 29C-243	Historic	No	Not Eligible
	Bridge 29C-399	Historic	No	Not Eligible
	Bridge 29-C400	Historic	No	Not Eligible

Water Conveyance

Portions of the Mokelumne Aqueduct and associated features are located within the study area. The aqueduct was recommended as eligible for listing in the NRHP under Criterion A for its association with the development of the east San Francisco Bay and Alameda and Contra Costa Counties. It was also recommended eligible under Criterion C as an example of the work of master engineer Arthur Powell Davis. The system is still regularly maintained and fully operational.

Railroads

A portion of the Atchison, Topeka and Santa Fe Railroad intersects the project area. The section of the railroad in the study area has yet to be recorded or evaluated for its eligibility for listing in the NRHP. A complex of railroad lines on Rough and Ready Island is discussed under the NSAS-HD.

Historic Structures

Three sites with historic structures were previously recorded within the study area, including the Central United Methodist Church, which was recommended eligible for listing in the NRHP under Criterion C for its architecture and engineering. The associated school building was recommended not eligible for listing in the NRHP as its architectural style is well represented in the Central Valley. The remaining two structures are houses. One has been recommended not eligible for listing in the NRHP and the second remains unevaluated.

Bridges

Eleven bridges were recorded within the study area. All were listed as not eligible by CalTrans.

Historical Archaeological Site

A single historical archaeological site, P-39-0342, was recorded in the study area. It is a trash scatter. The site was determined not eligible for listing in the NRHP in 2000.

Naval Supply Annex Stockton Historic District (NSAS-HD)

The remaining six resources are associated with the NSAS-HD. One of the recorded resources refers to the entire district, P-39-4576. P-39-4576 is the NSAS-HD located on Rough and Ready Island and occupies nearly 1500 acres. The NSAS-HD is organized as an orthogonal grid of streets oriented to the cardinal directions, with a network of rail line overlying the street grid. Buildings within the district include 38 warehouses, 9 transit sheds and open storage areas, as well as utilitarian and personnel support buildings. Open areas around the periphery of the grid were also used as storage capabilities of the island. The railroad network includes a holding and reassignment yard and a classification yard. Spurs run from the rail yards to every warehouse and transit shed, as well as open storage areas. Only a portion of the NSAS-HD is located within the study area, including an entry gate, marginal wharf, vehicle bridge, the railroad spurs and railroad bridge (Table 5-44). The historic district was determined eligible for listing in the NRHP under Criteria A and C for its role in supplying the fleet during World War II and as an important example of new warehouse design developed during World War II. Because the operation of the historic district was being transferred from the Navy to the Port of Stockton and may cause adverse effects to the NRHP eligible site, HABS documentation was completed under Section 110(b)(2)a pursuant to a Memorandum of Agreement in 1998 (HABS No. CA-682).

Consultation

During the preconstruction engineering and design phase of the project, if authorized, USACE would then do a site-specific analysis including site-specific engineering and full site surveys in accordance with the processes set up in the PA. USACE shall prepare supplements to either draft or final environmental impact statements if: (1) USACE makes substantial changes in the proposed action that are relevant to environmental concerns; or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. If necessary, USACE would re-initiate Section 106 consultation with the State Historic Preservation Office (SHPO) and the Tribes to address any potential change in impacts.

State Historic Preservation Officer

USACE determined that the proposed undertaking would likely result in adverse effects to historic properties. Substantial portions of the APE have either not been surveyed or have been surveyed over five or even 10 years ago. USACE has prepared and initiated consultation concerning a PA with SHPO and Native American Tribes to guide the Section 106 process during project implementation. Before any ground disturbing activities commence, complete archaeological and historic building surveys would be completed as necessary. The PA has stipulations to address the identification and evaluation of cultural resources and development and implementation of historic property treatment plans (HPTPs). Specific mitigation measures would be developed in accordance with the PA to address any adverse effects on historic properties. A draft of the PA was submitted to SHPO on December 16, 2013. Comments from SHPO were received March 5, 2014. A copy of the draft PA can be found in the Engineering Addendum. The PA was executed by USACE and SHPO on May 11, 2016.

Native American Consultation

A list of potentially interested Native Americans was obtained from the District Native American Coordinator at Caltrans District 10 in Stockton. Two letters were sent to the Ione Band of Miwok Indians, the Buena Vista Rancheria of Me-Wuk Indians, the Wilton Rancheria, the Nototomne/Northern Valley Yokuts and the California Valley Miwok Tribe.

The first letter, dated August 12, 2012, informed them of the new feasibility study and requested any information they may have on areas of traditional cultural interest to their tribal members. There were two responses. Ms. Sylvia Burley, Tribal Chairperson of the California Valley Miwok Indians, requested Government to Government consultation which was forwarded to Mr. Mark Gilfillan, the USACE Tribal Liaison. Ms. Katherine Perez, Tribal Chairwoman for the Nototomne/Northern Valley Yokuts, called to request more information.

The first letters were sent out on December 2, 2013, including a description, location maps of the final array of alternatives, and a copy of the draft PA for review. A call from Mr. Randy Yonemura concerning the PA was received in December 2013; however, no specific comments have been submitted by any Tribe.

Since the first letters were sent out, USACE developed a revised draft Programmatic Agreement (PA) for the project. A second round of letters were sent on March 18, 2016 with a copy of the revised draft PA for review. No comments were received from the Tribes regarding the revised draft PA.

A final draft of the PA was distributed to tribes on August 13, 2014. In response, a letter from the California Valley Miwok Tribe stating they had no further comments and were requesting concurring party status was received on August 15, 2014. Ms. Perez called USACE for additional information, stated that she was very concerned about the possibility of human burials within the project area, and requested concurring party status. She chose to sign the final draft form of the document and submitted it via facsimile on August 20, 2014. USACE received comments concerning the project and PA from the Buena Vista Rancheria on August 29, 2014. USACE has provided the Buena Vista Rancheria responses to their comments in May 2016.

The United Auburn Indian Community expressed interest in this project on November 23, 2015 and have since been included in consultations.

The Draft Integrated Report was provided, and the Final Integrated Report will be provided to, the following Tribes: Wilson Rancheria, Nototomne/Northern Valley Yokuts, Californian Valley Miwok Tribe, Ione Band of Miwok Indian, United Auburn Indian Community, and Buena Vista Rancheria Me-Wuk Indians.

A PA has been signed by USACE and SHPO on May 11, 2016 as part of the submittal of this document.

5.21.2 ASSESSMENT METHODS AND BASIS OF SIGNIFICANCE

Assessment Methods

Analysis of the potential impacts was based on evaluation of changes to historic properties within the study area that may result from implementation of the project. The term "historic property" refers to any cultural resource that has been found eligible for listing or is listed, in the NRHP. Section 106 of the NHPA outlines the process in which Federal agencies are required to determine the effects of their undertakings on historic properties. In making a determination of the effects to historic properties, consideration was given to:

- Specific changes in the characteristics of historic properties in the study area.
- The temporary or permanent nature of changes to historic properties and the visual study area around the historic properties.
- The existing integrity considerations of historic properties in the study area and how the integrity was related to the specific criterion that makes a historic property eligible for listing in the NRHP.

Basis of Significance

Effects to cultural resources would be from four types of construction related actions: (1) effects to the integrity of the visual and physical setting of historic properties; (2) effects to the structural integrity of historic buildings and structures from demolition; (3) effects from earth moving activities; and (4) effects from clearing, grubbing and follow-on planting.

Any adverse effects on cultural resources that are listed or eligible for listing in the NRHP (i.e., historic properties) are considered to be significant. Effects are considered to be adverse if they:

- Alter, directly or indirectly, any of the characteristics of a cultural resource that qualify that resource for the NRHP so that the integrity of the resource's location, design, setting, materials, workmanship, feeling or association is diminished.
- Additionally, according to CEQA, a project that may cause a "substantial adverse change" in the significance of a "historical resource" or a "unique archaeological resource" may have a significant impact on the environment (State CEQA Guidelines Section 15064.5, PRC 21083.2). CEQA defines a "substantial adverse change" as follows:
    - Physical demolition, destruction, relocation or alteration of the resource or its immediate surroundings such that the significance of a historical resource would be materially impaired.
    - Demolition or material alteration in an adverse manner of those physical characteristics of a historical resource which convey its historical significance and justify its inclusion in or eligibility for inclusion in the California Register of Historical Resources, inclusion in a local register pursuant to Section 5020.1(k) of the PRC or its identification in a historical resources survey meeting the requirements of Section 5024.1(g) of the PRC.
- Disturb any human remains, including those interred outside of formal cemeteries.

5.21.3 ALTERNATIVE 1 - NO ACTION

Under NEPA, this alternative reflects the expected future conditions without this project. Under CEQA, it reflects the existing condition at the time the Notice of Preparation was published (January 2010) and what would be reasonably expected to occur in the foreseeable future if the project was not approved. Levee erosion and seepage would continue. Historic properties currently behind the existing levees may be affected in the event of a levee failure and impacts would be **significant and unavoidable**.

5.21.4 ALTERNATIVE 7A

Alternative 7a has the potential to adversely affect cultural resources during placement of cutoff walls, seepage berms, deep soil mixing, levee raises and closure structures. The records and literature search, reconnaissance survey and the regional history of the area indicate that there are at least 30 previously recorded cultural resources and high potential for additional unknown historic properties within the study area. In particular, the prehistoric overview and previously recorded prehistoric sites suggests that there is a high probability that multiple prehistoric villages on the SJR and tributaries would be affected. The likelihood is also high for additional historic-era structures and features within the project. It is likely that historic properties will be adversely affected by this alternative. Effects to cultural resources under this alternative would be **significant and unavoidable**.

5.21.5 ALTERNATIVE 7B

Alternative 7b would incorporate the same proposed methods along the same levee elements as Alternative 7a, with the added improvements to RD 17. At least 30 cultural resources were previously recorded within or adjacent to the study area. The addition of RD 17 would likely result in more resources located within the study area. A record search was not performed within RD 17 and given the similarity of riverside environment, it is likely that a similar number of historic and prehistoric resources are located in or near the study area. Historic properties are likely to be adversely impacted by this alternative. Implementation of mitigation for effects to cultural resources under this alternative would reduce impacts, but would remain **significant and unavoidable**.

5.21.6 ALTERNATIVE 8A

Alternative 8a would encompass the same proposed methods for reducing flood risk as Alternative 7a over an increased number of levee miles. At least 44 cultural resources were previously recorded within or adjacent to the study area. The increased length of the project area would result in a greater likelihood for additional resources to be located within the study area. In particular, the prehistoric overview and previously recorded prehistoric sites suggests that there is a high probability that multiple prehistoric villages on the SJR would be affected. Historic properties are likely to be adversely impacted by this alternative. Implementation of mitigation for effects to cultural resources under this alternative would reduce impacts, but would remain **significant and unavoidable**.

5.21.7 ALTERNATIVE 8B

Alternative 8b would incorporate the same proposed methods along the same levee elements as Alternative 8a, with the added improvements to RD 17. At least 44 cultural resources are known to be within or adjacent to the study area. The addition of RD 17 would likely result in more resources located within the study area. A record search was not performed within RD 17 and given the similarity of riverside environment, it is likely that a similar number of resources are located in or near the study area. Historic properties are likely to be adversely impacted. Implementation of mitigation for effects to cultural resources would reduce impacts, but would remain **significant and unavoidable**.

5.21.8 ALTERNATIVE 9A

Alternative 9a would incorporate the same proposed methods along the same levee elements as Alternative 7a, with the addition of channel improvements to create a bypass through Old Mormon Slough. At least 37 cultural resources were previously recorded within or adjacent to the study area. In particular, the prehistoric overview and previously recorded prehistoric sites, suggests that there is a high probability that multiple prehistoric villages on the SJR would be affected. A record search was not completed along Old Mormon Slough, but given the similarity of riverside environment, it is likely that a similar number of resources are located in or near the study area. The additional length of the project area could also result in a greater likelihood for additional resources to be located within the study area. Historic properties are likely to be adversely impacted by this alternative. Implementation of mitigation for effects to cultural resources would reduce impacts, but would remain **significant and unavoidable**.

5.21.9 ALTERNATIVE 9B

Alternative 9b would incorporate the same proposed methods along the same levee elements as Alternative 9a, with the addition to improvements to RD 17. At least 37 resources are known to be within or adjacent to the study area. The addition of RD 17 would likely result in more resources located within the study area. A record search was not completed along Mormon Slough or RD 17, but given the similarity of riverside environment, it is likely that a similar number of resources are located in or near the study area. Historic properties are likely to be adversely impacted by this alternative. Implementation of mitigation for effects to cultural resources would reduce impacts, but would remain **significant and unavoidable**.

5.21.10 MITIGATION

USACE began consultation concerning a PA with SHPO and Native American Tribes (Environmental Addendum). A fully executed PA will be in place prior to project implementation. Specific mitigation measures would be developed in accordance with the PA to address any adverse effects on historic properties through the development of an HPTP. The HPTP would guide the level of data recovery, mitigation or actions taken to resolve adverse effects to the historic property. The main requirements of the contents of a research design and HPTP are located in the PA.

Depending on the nature of the adverse effect, actions to protect or mitigate for adverse effects to historic properties may include the following:

- Redesigning the project to avoid historic properties or sensitive areas.
- Conducting data recovery excavations of archaeological sites that cannot be avoided or are discovered during construction, based on an approved HPTP.
- Monitoring all ground disturbing construction activities in areas where buried resources are anticipated.
- Surveying and protecting exposed inundated cultural deposits.
- Protecting exposed archaeological sites from vandalism and erosion with fencing and revegetation or capping sites in an approved manner with appropriate material.
- Preparing and implementing an inadvertent discovery plan.
- If previously undiscovered resources are identified during an undertaking, suspend work while the resource is evaluated and mitigated to avoid any further impact.
- Continue to consult with Native American or other groups to identify any traditional cultural properties or resource uses and address impacts.
- If human remains are discovered during any activities associated with bank protection measures, USACE, CVFPB and SJAFCA and their contractors will comply with State and Federal laws relating to the discovery and identification of human remains. In the case of Native American human remains found on non-Federal land, USACE and DWR will consult with the most likely descendant of the deceased regarding the disposition of human remains and associated burial items pursuant to the PA. This process includes contacting the coroner and developing a plan for the removal or protection of the remains pursuant to the PA.

Even with implementation of the PA, impacts to cultural resources would be **significant and unavoidable**.

5.22 GROWTH INDUCEMENT

NEPA and CEQA require that an EIS and EIR discuss how a project, if implemented, could induce growth. This section presents an analysis of the potential growth-inducing effects of the proposed project. Direct growth inducement would result if a project resulted in establishing a new demand for public services, facilities or infrastructure, such as the construction of new housing. Indirect growth inducement would result, for instance, if implementing a project would result in any of the following:

- Substantial new permanent employment opportunities (e.g., commercial, industrial or governmental enterprises);
- Substantial short-term employment opportunities (e.g., construction employment) that indirectly stimulates the need for additional housing and services to support the new temporary employment demand; and/or
- Removal of an obstacle to additional growth and development, such as removing a constraint on a required public utility or service (e.g., construction of a major sewer line with excess capacity through an undeveloped area).

5.22.1 DIRECT GROWTH EFFECTS

Construction activities associated with implementation of the LSJR Project would generate short-term employment. It is anticipated that there is sufficient workforce in the Stockton Metropolitan Area to support construction of the project, if approved. Because the existing labor force would be used, there would be no need for additional housing to be constructed and no new demand for public services, facilities or infrastructure. O&M of the project would not result in an increase in employees beyond current levels. If additional employees were needed, those jobs would be anticipated to be filled by the existing labor force. Therefore, implementation of the LSJR Project would not directly induce growth as a result of an increase in population or in construction of new housing and associated support infrastructure.

5.22.2 INDIRECT GROWTH EFFECTS

Within the project area, population growth and urban development are driven by local, regional and National economic conditions. Between 2006 and 2011, the annual average population growth rate of San Joaquin County was 1 percent. The projected annual population growth rate for the county between 2012 and 2017 is anticipated to be 1.7 percent (San Joaquin County, 2010). Local land use decisions are within the jurisdiction of the Cities of Stockton, Lathrop and Manteca and San Joaquin County each who have adopted general plans, consistent with State law, that provide an overall framework for growth and development within their jurisdictions and the study area (including North Stockton, Central Stockton and RD 17). There are currently 15,500 acres of undeveloped land in the study area, including 12,800 acres in RD 17 and the remaining 2,700 acres in North and Central Stockton.

While each of the proposed alternatives improves levees to protect existing populations in the study area, Alternatives 7b, 8b, and 9b also would provide protection of currently undeveloped land in RD 17, therefore removing flood risk as an obstacle to growth. The magnitude of this potential impact was considered during project planning, including identification of the RP. EO 11988, Floodplain Management Analysis, is provided in Section 3.6. The Lower SJR Project Feasibility Study concluded that strengthening the existing system of levees, along with two closure structures, is the only practicable alternative to address FRM to the greatest population (located in North and Central Stockton), while minimizing induced development in the less populated RD 17.

The Stockton, Manteca and Lathrop General Plans designated 5,300 acres of agricultural and open space in RD 17 for urban uses. These plans are currently under revision and it is likely that the acreage may be

reduced. Population growth associated with the urbanization of RD 17 would result in the physical development/expansion of housing, transportation systems, utilities and services, which could adversely affect the physical environment. As presented in Table 5-45, buildout of development projects in RD 17 would result in significant and unavoidable impacts including, but not limited to, conversion of prime farmland, criteria air pollutant emissions, increased light and glare, increased traffic congestion and increased noise levels. In addition, the cities worked together with San Joaquin County and other partners and Federal, State and local regulators to develop and approve the San Joaquin County Multi-Species Conservation and Open Space Plan (2000). This plan recognizes the planned urban development and defines a comprehensive plan for conserving and mitigating for impacts to sensitive natural resources.

USACE and SJAFCA lack the authority to approve or deny development projects or to impose mitigation to address significant environmental impacts due to land use decisions; that authority resides with the local cities and San Joaquin County. In addition, numerous Federal, State, regional and local agencies are specifically charged with protecting environmental resources and ensuring that planned development occurs in a sustainable manner. Together, these agencies exercise the authority to reduce the effects of development on the environment. However, development to accommodate population growth in RD 17 due to reduction in flood risk would still be expected to result in significant and unavoidable impacts.

5.23 CUMULATIVE EFFECTS

NEPA and CEQA require the consideration of cumulative effects of the proposed action combined with those of other projects. NEPA defines a cumulative effect as an environmental affect that results from the incremental effect of an action when combined with other past, present and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7). The CEQA Guidelines require an assessment of the cumulative impacts of a project when the project's incremental effect is "cumulatively considerable." CEQA requires cumulative impacts of a project be assessed with respect to past, current and probable future projects within the region. *CEQA Guidelines* (Section 15355) define cumulative effects as "two or more individual effects that, when considered together, are considerable or which compound or increase other environmental impacts." According to CEQA Guidelines Section 15130 (b), the purpose of the cumulative impacts discussion shall reflect "the severity of the impacts and their likelihood of occurrence" and shall "be guided by the standards of practicality and reasonableness and should focus on the cumulative impact to which the identified other projects contribute..." As further defined in Section 15130 (b), an element necessary to an adequate discussion of significant cumulative impacts is a list of past, present and probable future projects producing related or cumulative impacts, including those projects outside the control of the Lead Agency (list approach); or a summary of projections contained in an adopted general plan or in a prior environmental document that was adopted or certified that described or evaluated regional or area-wide conditions contributing to the cumulative impact (plan approach). This cumulative analysis uses the list approach. Section 5.23.3 includes a description of the past, present and future projects.

5.23.1 METHODOLOGY AND GEOGRAPHIC SCOPE OF THE ANALYSIS

Methodology

If a technical issue area includes a project-specific impact as a result of implementation of a proposed alternative, a cumulative context is presented. The cumulative impact analysis takes into consideration whether the projects identified in Section 5.23.3, in combination with each of the alternatives, would have the potential to affect the same resources. If there is not a combined effect, then a finding of no cumulative impact is made. If there would be a combined effect, then a determination is made if that combined effect would: (1) result in a significant cumulative impact; and (2) if a proposed alternative's contribution to the effect would be considerable (consistent with CEQA Guidelines Section 15355).

Finally, a determination is made as to whether mitigation measures recommended for the project-specific impact would reduce the contribution to the cumulative impact to a less than significant level; therefore, resulting in a less than significant cumulative impact. Mitigation of significant cumulative effects could be accomplished by rescheduling actions of proposed projects and adopting different technologies to meet compliances. Significance of cumulative effects is determined by meeting Federal and State mandates and specified criteria identified in this document for affected resources.

Geographic Scope

The context of the cumulative analysis varies by technical issue area. The cumulative context for each technical issue area is further defined by the specific geographic area affected. Air and water resources extend beyond the confines of the project footprint since effects on these resources would not necessarily be confined to the project area. When the effects of the project are considered in combination with those of other past, present and future projects to identify cumulative effects, the other projects that are considered may also vary depending on the type of environmental effects being assessed. The following are the general geographic areas associated with the different resources being addressed in this analysis:

Table 5-45: Geographic Area That Would be Affected by the LSJR Project

Resource Area	Geographic Area
Land use and agriculture	San Joaquin County, City of Stockton
Hydrology and Hydraulics	The LSJR project area, with regional implications, including: SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough and in the vicinity of the study
Water quality	The LSJR project area, with regional implications, including: SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough and in the vicinity of the study
Vegetation	The LSJR project area, with regional implications, including: individual construction sites and SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough
Wildlife	The LSJR project area, with regional implications, including: individual construction sites and SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough
Fisheries	The LSJR project area, with regional implications, including: individual construction sites and SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough
Special-status species	The LSJR project area, with regional implications, including: individual construction sites and SJR, Lower Calaveras River, Stockton Deepwater Ship Channel, Tenmile Slough, Fivemile Slough, Fourteenmile Slough, Mosher Slough
Fish and aquatic habitats	SJR system, Mosher Slough/Creek, Fourteenmile Slough, Tenmile Slough, Fivemile Slough, Calaveras River, Stockton Diverting Canal, Old Mormon Slough, French Camp Sough and the South Delta, with regional implications for species
Cultural resources	Individual ground disturbance sites, with regional implications
Transportation and circulation	Roadway network within the study area, including Cities of Stockton, Manteca, Lathrop and western portion of San Joaquin County, with regional implications
Air quality	Regional (SJCAPCD); global for GHG emissions
Noise	Immediate vicinity of the individual sites of construction activity and haul routes.
Recreation	Local (facilities near construction sites)
Visual resources	Individual levee improvement sites and landscape level
Hazards and hazardous materials	Individual construction and other ground disturbance sites
SJCAPCD = San Joaquin County Air Pollution Control District	

5.23.2 LSJR PROJECT IMPACTS

The potential impacts from implementing the LSJR project are summarized inTable ES-5. Significant and unavoidable impacts from implementing the RP, Alternative 7a, are shown in Table 5-45.

5.23.3 PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE PROJECTS

This section briefly describes the past, present and future projects in the LSJR study area. The exact construction timing and sequencing of these projects are not yet determined or may depend on uncertain funding sources. A forecast of projects likely to be constructed concurrently with the proposed project is required to evaluate cumulative effects on environmental resources in the area. In addition, mitigation or mitigation measures must be developed to avoid or reduce any adverse effects to less than significant based on Federal and local agency criteria. Those effects that cannot be avoided or reduced to less than significant, are more likely to contribute to cumulative effects in the area.

Projects with a FRM Emphasis

The following descriptions of related or similar FRM projects include those that are under active consideration, were proposed or have some form of environmental documentation completed. In addition, these projects have the potential to affect the same resources and fall within the same geographic scope and are thus to be cumulatively considered. In particular, the affected resources are biological resources (riparian habitat, wildlife disturbance), agriculture, air quality and GHGs (climate change), hydrology and geomorphology. See Table 5-45 for the geographic scope of consideration for effects on those resources.

Delta Flood Emergency Facilities Improvement Project

Recovery from catastrophic failure of Delta levees will be undertaken by the State of California, if necessary, to manage salinity for the environment and human use, which will also protect the brackish Suisun Marsh. As described in DWR's Delta Flood Emergency Facilities Improvement Project, the State is working to ensure that it has the appropriate infrastructure and supplies in the Delta to respond to and recover quickly and effectively from, major flood or earthquake disasters in the Delta. Locations of storage and transfer sites for stockpiled flood fight materials are identified:

- Establish two new material storage and transfer facility sites:
  - Stockton West Weber Avenue; and
  - Brannan Island State Park.
- Modify an existing material storage 5.23.3 facility at Rio Vista.
- Establish new flood fight supply facilities at all three locations.
- Make site preparations to support Incident Command Posts at Stockton West, Weber Avenue and Brannan Island State Recreation Area.
- In addition to the 223,000 tons of quarry rock stockpiled by DWR at Rio Vista and within the Port of Stockton, DWR would also stockpile up to 40,000 tons of quarry rock material of variable gradations less than 24-inch-minus at Stockton West, Weber Avenue and Brannan Island and 20,000 tons of sand in Rio Vista for a total additional increment of 100,000 tons.

Designated Floodway Program

The CVFPB of the State of California administers the Designated Floodway Program, which addresses land use management within the floodway. This program provides a nonstructural way to keep development from encroaching into flood-prone areas. It also reduces future potential flood damages by preserving the reasonable flood passage capacities of natural watercourses. The CVFPB controls the Designated Floodway Program by adopting floodway boundaries, developing plans for modifications of boundaries and approving changes in acceptable use and types of structures within the floodways. Designated Floodway refers to the channel of the stream and that portion of the adjoining floodplain reasonably required to provide for the passage of a design flood. It is also the floodway between existing levees as adopted by the CVFPB (formerly the Reclamation Board) or the Legislature. Floodways in the study area are primarily limited to the areas between levees.

Federal Emergency Management Agency (FEMA), Flood Mitigation Assistance Program and the Hazard Mitigation Grant Program

These programs seek to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards. In order to qualify for these programs, a community must be enrolled in the NFIP and have a Flood Mitigation Plan approved by the FEMA Regional Director. This plan must include a description of the existing flood hazard and identification of the flood risk including estimates of the number and type of structures at risk, repetitive loss properties and the extent of flood depth and damage potential. A project must be cost-effective, not costing more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if these programs must compete for the funding. The Cities of Stockton, Lathrop and Manteca are enrolled in the NFIP. San Joaquin County's enrollment covers the unincorporated areas of the County, which includes the study area outside of the Stockton, Lathrop and Manteca city limits.

SJR Levee Stability Program

Reclamation District No. 17 Levee Seepage Area Project (LSAP)

The RD 17 LSAP consists of 3 phases of levee repairs to remedy levee seepage within the RD 17 levee system.

Phase 1 Project. In RD 17, improvements to some levee reaches consisted of reconstruction and extension of landside levee toe berms with earth and gravel fill, both landward and along the levee toe so as to reduce seepage exit gradients to less than 0.5. Project proponents concluded that there was no NEPA trigger for the Phase 1 Project and this phase was found to be statutorily exempt from CEQA. The Phase 1 Project was found to be categorically exempt from CEQA because the work consisted of repairing existing public facilities, involved no expansion of use (CCR 15301) and consisted of reconstructing existing facilities located on the same site. In addition, the Phase 1 Project was found to be categorically exempt because the facilities were planned to have the same purposes and capacity (CCR 15302). The levee elements selected for the Phase I Project were chosen because these elements lacked any sensitive environmental resources that would potentially be affected by construction activities. The Phase 1 Project was completed in 2008.

Phase 2 Project. Consisted of repairs and improvements to additional levee segments in RD 17. Under CEQA, environmental impacts associated with the Phase 2 Project were addressed in the *Initial Study/Proposed Mitigated Negative Declaration for the Phase II–RD 17 100 Year Levee Seepage Project* (RD 17 2009). Project proponents determined that there was no NEPA trigger for the Phase 2 work. Construction of the Phase 2 Project was completed in the summer of 2010.

Phase 3 Project. RD 17 is the lead agency for Phase 3 of the LSAP. A variety of levee improvements are being considered for the Phase 3 Project, including construction of seepage berms and setback levees, installation of slurry cutoff walls and chimney/blanket drains and improvements to dry land levees to reduce under seepage and through seepage gradients. Proposed levee improvements would occur along various sections of the RD 17 levee system starting near the southern boundary of the city of Stockton, through the city of Lathrop and to the western boundary of the City of Manteca. RD 17 initiated this effort in cooperation with DWR, CVFPB, USACE with the aim of reducing flood risk during a flood with a 1 percent chance of occurring in any given year or 0.01 AEP. USACE will have a Section 408 and, potentially, a Section 404 decision on this project. Section 408 authority and approvals are in Section 5.23.4. A Draft EIS/EIR for this project was prepared and circulated in September 2011. The Final EIS has not been released.

Paradise Cut

Calif & LLC/Cambay group is planning the Paradise Cut project. Improvements to Paradise Cut associated with the River Islands at Lathrop Project would increase floodwater conveyance capacity and storage capacity of Paradise Cut. These actions would be consistent with the South Delta Flood Conveyance Plan.

Central Valley Flood Protection Plan (CVFPP) of 2017

The State's (DWR) comprehensive, system-wide plan for reducing flood risks to lands currently protected by the SJR Basin Flood Control Project lays out the State's broad plan for the Central Valley. Through the 2017 CVFPP, DWR initiated the Regional Flood Management Planning effort to assist local agencies in developing long-term regional flood management plans. Plans should identify local needs, local and regional flood management priorities and establish a common vision for partners. The CVFPP identified nine regions (Upper Sacramento, Mid-Sacramento, Feather River, Lower Sacramento, Delta-North, Delta-South, Lower San Joaquin, Mid-San Joaquin and Upper San Joaquin), which have formed working groups led by a local agency and consists of representatives from flood management agencies, land use agencies, flood emergency responders, permitting agencies and environmental and agricultural interests. The regional plans will present local agencies' perspectives of flood management with a prioritized list of projects that need to be implemented to reduce flood risks in each region. Each plan will also present an assessment of the proposed project costs and benefits, considering the projects' potential contributions to an integrated multi-benefit and basin-wide solution.

CALFED Levee System Integrity Program

The goal of the CALFED Levee System Integrity Program is to reduce risk to land use and associated economic activities, water supply, agriculture and residential use, infrastructure and the ecosystem from the effects of catastrophic breaching of Delta levees. Estimates predict that 520 miles of levees need modification and maintenance to meet the PL 84-99 standard for Delta levees. The program continues to increase levee stability throughout the Delta.

Delta Islands and Levees Feasibility Study

USACE's Delta Islands and Levees Feasibility Study (Delta Study) is assessing ecosystem restoration opportunities and flood risk problems in the Delta area. A Draft FR/EIS was released for public review in April 2014, tentatively recommending 90 acres of intertidal marsh restoration in the central Delta. Pending reviews, the report would be finalized as an interim feasibility report that would make recommendations on construction projects and/or additional studies for authorization by Congress.

The Delta Plan

The Delta Plan was developed by the Delta Stewardship Council (DSC) and adopted on May 16, 2013. It became effective, with legally-enforceable regulations, on September 1, 2013. It is a long-term, comprehensive management plan designed to meet the 2 co-equal goals of providing a more reliable water supply for California and protecting, restoring and enhancing the Delta ecosystem. The Delta Plan generally covers 5 topic areas and goals: increased water supply reliability, restoration of the Delta ecosystem, improved water quality, reduced risks of flooding in the Delta and protection and enhancement of the Delta. The DSC does not propose constructing, owning or operating any facilities related to these 5 topic areas. Rather, the Delta Plan sets forth regulatory policies and recommendations that seek to influence the actions, activities and projects of cities, counties, State, Federal, regional and local agencies toward meeting the goals in the 5 topic areas.

The Delta Plan could contribute to beneficial cumulative effects by setting forth regulatory policies and recommendations that influence projects in a manner that would improve water quality, water supply reliability, FRM and increase habitat for fish and wildlife.

Navigation Projects

San Francisco Bay to Stockton Deep Water Ship Channel Deepening Project

USACE, DWR and the Port of Stockton conduct annual maintenance dredging of the Stockton Deep Water Ship Channel. Annual maintenance dredging is performed to maintain the DWSC to authorized depths. Fine sediments cause shoaling, which must be removed to maintain adequate depth for commercial shipping traffic using the navigation channels. Failure to perform maintenance dredging would result in unsafe conditions and a restriction to access to the Port of Stockton from the San Francisco Bay, both a substantial risk to human safety, as well as an economic harm to the Port and the commercial activities that use the Port's facilities.

Dredged materials are removed by using a hydraulic cutter head suction dredge and a dragline and clamshell crane are used for rock placement. The material is then deposited at previously authorized Dredged Material Placement (DMP) sites. Dredge slurry is routed to the DMP sites via pipelines. DMP sites are diked and dredge slurry is allowed to settle and consolidate at these sites. Decant water is then discharged back into the waterway, from some sites, as determined during annual coordination. Dredged spoils are allowed to dry and remain stockpiled at the sites for periodic use for levee repairs, livestock grazing and other purposes.

Projects Affecting Fish and Wildlife That Use the Project Area

As described in Sections 5.9, 5.10, 5.11 and 5.12, substantial long-term effects on vegetation, fish and wildlife are related to the removal of vegetation in compliance with the USACE levee vegetation management policy. Regarding wildlife, this could contribute to a cumulative effect when combined with other projects that adversely affect habitat for wildlife that use the vegetation on or near levees in the project area. Regarding fish, this could contribute to a cumulative effect when combined with other projects within the geographic range of the fish that would be affected. Thus, the FRM and navigation projects described above in Section 5.23.3 could also adversely affect the same species of fish or wildlife that would be affected by vegetation removal under the project. The projects described intend to improve habitat conditions for the natural environment and the plants and animals that depend upon it.

CALFED Ecosystem Restoration Program

The goals of the CALFED Ecosystem Restoration Program are to:

- Recover 19 at-risk native species and contribute to the recovery of 25 additional species.
- Rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water supply.
- Maintain and enhance fish populations critical to commercial, sport and recreational fisheries.
- Protect and restore functional habitats, including aquatic, upland and riparian, to allow species to thrive.
- Reduce the negative effects of invasive species and prevent additional introductions that compete with and destroy native species.
- Improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The Ecosystem Restoration Program, which is divided into the San Joaquin, Sacramento and Delta and Eastside tributary regions, includes the following kinds of actions:

- Develop and implement habitat management and restoration actions, including restoration of river corridors and floodplains, reconstruction of channel-floodplain interactions and restoration of Delta aquatic habitats.
- Restore habitat that would specifically benefit one or more at-risk species.
- Continue major fish screen projects and conduct studies to improve knowledge of their effects.
- Restore geomorphic processes in stream and riparian corridors.
- Implement actions to improve understanding of at-risk species.
- Develop understanding and technologies to reduce the effects of irrigation drainage on the SJR and reduce transport of contaminant (selenium) loads carried by the San Joaquin to the Delta and the Bay.
- Implement actions to prevent, control and reduce effects from nonnative invasive species.

Ecosystem Restoration Program actions contribute to cumulative beneficial effects on fish and wildlife species, habitats and ecological processes.

California Water Fix

On April 30, 2015, Governor Brown and Federal officials announced that they are proposing a new Bay Delta Conservation Plan (BDCP) sub-alternative, Alternative 4A, that would replace BDCP Alternative 4 (the proposed BDCP) as the State's proposed project. Alternative 4A reflects the State's proposal to separate the conveyance facility and habitat restoration measures into 2 separate efforts: California WaterFix and California EcoRestore. California EcoRestore, the primary habitat restoration program, would be overseen by the California Natural Resources Agency and implemented under the California Water Action Plan. These 2 efforts are a direct reflection of public comments and fulfill the requirement of the 2009 Delta Reform Act to meet the co-equal goals. DWR and the USBR prepared a partially Recirculated Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement (RDEIR/SDEIS) that addresses the impacts of Alternative 4A. The RDEIR/SDEIS includes those portions of the DEIR/DEIS (for the BDCP) that were amended or supplemented based on comments received and changes in impact analysis warranting another public review prior to publication of final documents.

Long Term Central Valley Project (CVP) BOs

BOs issued by USFWS and NMFS for CVP and the SWP determined that the existing fish passage structure at Fremont Weir was inadequate to allow normal fish passage at most operational levels of the Sacramento River. As a result, BOs required the USBR and/or DWR to increase inundation of suitable acreage for fish habitat within the Yolo Bypass and to modify operations of the Sacramento Weir or Fremont Weir to increase juvenile rearing habitat. The BOs also require restoration of 8,000 acres of tidal marsh habitat in the Delta to benefit Delta smelt and up to 20,000 acres of salmonid habitat restoration. The operations of the SWP and CVP are currently subject to the terms and conditions of these BOs until the new water conveyance infrastructure identified in the BDCP becomes operational. At that time, an integrated BO on coordinated long-term operation of the CVP and SWP will be completed by USFWS and NMFS. Implementation of the BOs is expected to be compatible with the LSJR project.

SJR Restoration Program

The USBR, USFWS, NMFS, DWR, DFG and Cal EPA are participating in the SJR Restoration Program. The goal of the program is to restore and maintain fish populations in the mainstem of the SJR below Friant Dam to the confluence of the Merced River and to reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors. The SJR Restoration Program involves operation of Friant Dam and downstream flow-control structures to release flows to the SJR and diversion of surplus water during wet hydrologic conditions to the Friant- Kern and Madera canals.

U.S. Department of Agriculture, NRCS Wetland Reserve Program

California's Wetlands Reserve Program focused on the restoration of a variety of wetland types throughout the State, including seasonal wetlands, semi-permanent marshes and vernal pools along the perimeter of the Central Valley, riparian corridors and tidally-influenced wetlands. The Wetland Reserve Program was used to restore land along the SJR that has experienced flooding.

USFWS, SJR National Wildlife Refuge

The SJR National Wildlife Refuge is located within the historic floodplain of the confluences of the San Joaquin, Stanislaus and Tuolumne Rivers and downstream from the confluence with Orestimba Creek. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields and wetlands. This refuge was established in 1987 under authority of the ESA, the Land and Water Conservation Fund Act and the Migratory Bird Conservation Act. The original 1,638 acre refuge has grown tremendously through recent land acquisitions to 6,642 acres within an approved refuge boundary of 12,877 acres.

USFWS, San Luis National Wildlife Refuge

This 26,609-acre refuge is a mixture of managed seasonal and permanent wetlands, riparian habitat associated with 3 major watercourses and native grasslands/alkali sinks/vernal pools. This refuge primarily provides habitats for migratory and wintering birds. The largest concentration of mallards, pintails and green-winged teal in the San Joaquin Valley are found here. One of only 22 herds of the indigenous Tule elk is located here, as are a variety of endangered, threatened and sensitive species.

Development Projects.

Table 5-46 are within RD 17 boundaries in the Cities of Manteca, Stockton, Lathrop and in unincorporated areas of San Joaquin County.

San Joaquin County Development Projects

Development projects in the sphere of influence of Stockton, Manteca and Lathrop that have the potential to affect similar resource areas such as biological resources, air and noise, have been included for analysis.

Table 5-46: Development Projects within RD 17

Jurisdiction	Date Approved/ Anticipated	Location	Size	Major Environmental Impacts
City of Lathrop				
Mossdale Landing[1,2]	Much of the overall development is complete.	West of I-5, adjacent SJR in RD 17	1,7000 units + commercial space	*West Lathrop Specific Plan Draft Environmental Impact Report* (City of Lathrop 1995:K-4) **Significant Unavoidable Impacts** Loss of Prime Farmland Increase in regional criteria air pollutant emissions Increase in light and glare Increase in traffic congestion Increased potential for flood damage
Mossdale Landing East[1,2]	Much of the overall development is complete.	West of I-5, adjacent SJR in RD 17	430 units + commercial space	
Mossdale Landing South[1,2]	Much of the overall development is complete.	West of I-5, adjacent SJR in RD 17	450 units + commercial space	
Central Lathrop Specific Plan[1]	Entitlements approved in 2004, annexed in 2005[3]. Some utilities and roadways installed. No structures in place. No immediate plans for further construction.	West of I-5, adjacent to SJR in RD 17 (north of Mossdale Landing)	6,800 units + 5 million sq. ft. office and commercial	*Central Lathrop specific Plan Draft Environmental Impact Report* (City of Lathrop 2004: 7-1; 7-5) **Significant Unavoidable Impacts** Deficient level of service at intersections and highway segments Increase in regional criteria air pollutants during construction period Increase in long-term regional emissions Increase in traffic noise levels by 3 dBA or more Noise levels would exceed city's "normally acceptable" land use compatibility standards

Jurisdiction	Date Approved/ Anticipated	Location	Size	Major Environmental Impacts
				Loss of Important Farmland in categories of Prime, Statewide and Local Importance
River Islands	River Islands is currently working with the State and Federal agencies to finalize the permits needed to begin development. (City of Lathrop 2010).	Stewart Tract (bounded by Paradise Cut, SJR and Old River; north of I-205 and west of the SJR	Up to 11,000 units _ 2 golf courses, 45-acre town center, boat docks, 260 acres of parks, 600 acres of lakes and waterways, 600 acres of open space (City of Lathrop 2002). Includes improvements to Paradise Cut (a flood control bypass), consistent with the South Delta Flood Conveyance Plan	*Draft Environmental Impact Report for the River Islands at Lathrop Project (City of Lathrop 2002: 2-9 to 2-77).* **Significant Unavoidable Impacts** Degradation of freeway and ramp operations on I-205 Degradation of freeway and ramp operations on I-5 Increases in long-term regional emissions Odors associated with water reclamation plants Conversion of 3,620 acres of Important Farmland in the Prime and Statewide Importance categories Cancellation of up to 1,770 acres of Williamson Act contracts
South Lathrop Specific Plan[4]	Pending – NOP/IS issued in 2006.	South of SR 120 at I-5/SR 120 split	689 acres GPA, prezone, annexation and SP	Environmental Review is pending
City of Manteca				

Jurisdiction	Date Approved/ Anticipated	Location	Size	Major Environmental Impacts
Trails Project[5]	Environmental review process is beginning.	Southwestern portion of Manteca, southwest of the intersection of West Woodward Avenue and McKinley Avenue. Adjacent to the dry land levee and near Oakwood Shores.	477 acres, 1,651-unit residential development	Environmental review is pending
Terra Ranch[5]	Tentative map application has been submitted. Environmental review process is beginning.	Southside of West Woodward Avenue, one-half mile west of Airport Way; southern boundary is adjacent to the dry land levee	Approx. 66 acres, 209 unit residential development	Environmental review is pending
Macado[5]	The environmental impact report has been certified. No application to LAFCo has been made; approval of tentative map is pending.	Southwest corner of West Woodward Avenue and Airport Way; Southern boundary is adjacent to the dry land levee	Approx. 155 acres, 590 unit residential development	*Draft Environmental Impact Report for Machado Estates Vol. I* (City of Manteca 2007: ES-5; 3-12) **Significant Unavoidable Impacts** Conversion of Prime Farmland, Unique Farmland, Farmland of Statewide Importance (59.9 acres) pg 3-12 Increase in emissions of criteria pollutants Unacceptable LOS on freeway ramps and mainline segments and local roadways
City of Stockton				
Weston Ranch Towne Center Project[1,6]	City Council approved December 2, 2008. Much of overall development is complete.	West side of I-5, north side of French Camp Road	500,000 sq. ft large-scale retail, 210,000 sq. ft retail: shops, restaurants, commercial	*Weston Ranch Towne Center Mitigation Monitoring and Reporting Program* (City of Stockton 2008) **Significant and Unavoidable Impacts**

Jurisdiction	Date Approved/ Anticipated	Location	Size	Major Environmental Impacts
				Conversion of Prime Farmland (42.24 acres) Deficient level of service at Mathews Road/I-5 ramp Traffic impacts at French Camp Road/I-5 Interchange Increase in emissions of criteria air pollutants
San Joaquin County				
Oakwood Shores[7] (Oakwood Lake)	Approved and partially constructed. Roads and utilities in place, but less than 10 housing units in place. No immediate plans for further construction.	South of SR 120/580 between Lathrop and Manteca	480 lots, 264 constructed; approx. 45 will be eliminated for levee work[4]	Not Applicable: Former sand and gravel extraction site and former site of Manteca Waterslides; was converted to lake and resort community; went into foreclosure in 2008
Notes: dBA = A-weighted decibels; I-5 = Interstate 5; GPA = general plan amendment; SP = specific plan; LAFCo = local agency formation commission; RD 17 = reclamation District No. 17; sq. ft. = square feet; SR 120 = State Route 120				
[1] City of Stockton 2006a:6-6 [2] Mossdale Village Planning Area in the West Lathrop Specific Plan, approved in 2002 [3] City of Lathrop 2010			[4] South Lathrop Specific Plan: Notice of Preparation/Initial Study (City of Lathrop 2006) [5] Durrer, pers. Comm., 2010 [6] Liaw. Pers. Comm., 2010 [7] Griffin, pers. Comm., 2010	
Source : Data compiled by AECOM in 2010				

5.23.4 PROJECTS REQUESTING SECTION 408 APPROVAL

Non-Federal project partners desiring to modify Federal works must request permission from USACE under Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408), referred to as "Section 408 permission." A number of projects in the Central Valley recently received 408 approval and others may request it. Table 5-47 summarizes those that received a letter of permission under Section 408 or that are seeking a letter of permission to alter a Federal project. These projects are listed for context.

Table 5-47: Projects Requesting Section 408 Approval

Project	Lead Agency	Letter of Permission Date
Letter of Permission Issued		
Cache Creek Setback Levee	DWR CA	22-May-13
West Sacramento Levee Improvement Project - CHP	WSAFCA	29-Jun-11
West Sacramento Levee Improvement Project - Rivers	WSAFCA	29-Jun-11
West Sacramento - I Street Bridge	WSAFCA	2010
TRLIA - Bear River Setback Levee + UPIC	TRLIA	19-Jun-06
TRLIA - Upper Yuba River Levee Improvement Project	TRLIA	24-Mar-11
TRLIA - Feather River Segment 2	TRLIA	12-Dec-06
TRLIA - Feather River Segment 1 and 3	TRLIA	3-Aug-07
TRLIA - Toe Road	TRLIA	9-Jul-13
Natomas Levee Improvement Project - Natomas Cross Canal, Phase 1	SAFCA	19-Jul-07
Natomas Levee Improvement Project - Sacramento River, Phase 2	SAFCA	2/20/2009 & 5/22/2009
Natomas Levee Improvement Project - Natomas East Main Drainage Canal, Phase 3	SAFCA	20-Apr-10
Natomas Levee Improvement Project - Sacramento River, Phase 4a	SAFCA	7-Mar-11
Feather River - Star Bend	LD1	16-Jun-09
Mid Valley - Knights Landing Ridge Cut	KLRDD	17-Apr-14
Anticipated Future Letters of Permission		
RD 17 - Mossdale	RD 17	2015
Southport	WSAFCA	2015
River Islands	City of Lathrop	2017
California Water Fix	DWR	To be determined

5.23.5 CUMULATIVE IMPACT ANALYSIS

The following describes the project's potential contribution to cumulative effects on each resource topic presented in Sections 5.1 through 5.21.

Geology and Geomorphology

Other development in the study area would be subject to the same types of geology and geomorphology as the LSJR Project. However, these types of impacts represent site-specific effects and do not result in a greater combined impact than the individual impacts. Further, the proposed levees would continue to affect local geomorphological process similar to existing conditions and would not further alter the natural river meander or deposition. Therefore, no cumulative effect would occur.

Seismicity

Other development in the study area would be subject to the same seismic conditions as the LSJR Project. Seismic hazards represent hazards to people and property on a site-specific basis and do not result in a greater combined impact than the individual impacts. Further, proposed facilities would be designed, constructed and maintained in compliance with the regulatory standards of USACE, CVFPB and the latest seismic design standards. As a result, levees, cutoff walls and floodwalls would be designed to avoid or minimize any potential for seismic-related failure. Thus, no cumulative effect would occur.

Soils and Mineral Resources

Soils

Other development in the study area would occur over soils with similar characteristics. These types of impacts represent site-specific effects and do not result in a greater combined impact than the individual impacts. Earth disturbing activities could increase rates of erosion over current conditions, resulting in increased sediment loading in receiving waters or increases in air-borne dust. The LSJR project would comply with NPDES General Construction Permit requirements by the RWQCB to prevent stormwater runoff from construction entering receiving waters. Therefore, there would be no cumulative impact.

Mineral Resources

The cumulative setting for mineral resources is site-specific to those areas where construction for the project would occur. The alternatives would have no short- or long-term effects on the acquisition, mining or processing of the mineral resources in the project area. None of the existing sand and gravel mining or processing operations, is located at the work sites. Because the project construction sites would be isolated from other projects in the region, there would be no cumulative impacts on mineral resources.

Hydrology and Hydraulics

The cumulative setting for effects on hydrology and hydraulics are the study area's streams and rivers, including reaches upstream and downstream, in addition to other FRM projects in the same reaches. FRM improvements in these reaches would reinforce existing levees and build new levees that would contain and redirect flood flows in a coordinated manner to prevent downstream effects on hydrology and hydraulics and reduce potential flooding or exceedance of stormwater drainage systems. All FRM projects are regulated and considered within the context of the regional system so that transfer of flood risk is avoided and no adverse, cumulative effects result. The LSJRFS project would not contribute to a cumulatively significant impact and cumulative impacts would be less than significant.

Water Quality

The cumulative setting for effects on water quality are those receiving waters within study area and within the Basin Plan. Construction activities have the potential to temporarily degrade water quality through the direct release of soil and construction materials into water bodies or the indirect release of contaminants into water bodies through runoff. All projects would be required to comply with NPDES General Construction Permit requirements for developing and implementing BMPs. Overall water quality would be required to meet the Basin Plan objectives. Related projects, including the RD 17 levee improvements and the Stockton Deep Water Ship Channel routine dredging and deepening project, could be under construction during the same timeframe as the LSJR project. If construction occurs during the same timeframe, receiving water quality could be diminished due to increased turbidity and/or inadvertent release of construction materials, resulting in significant cumulative impacts. Construction of the LSJR project would have a less

than significant impact, which could nevertheless contribute to a cumulatively significant temporary degradation of water quality. The impacts of the in-water closure structures at Smith Canal and on Fourteenmile Slough would be mitigated to less than significant and would not contribute to a cumulatively significant impact on water quality.

Groundwater

The cumulative setting for groundwater impacts include the regional groundwater basin for impacts related to supplies and site-specific locations relative to construction activities for the project improvements that include cutoff walls for groundwater quality. Project alternatives would not prevent the percolation or movement of the underlying groundwater basin and would not use groundwater and there would be no cumulative impact to groundwater supply. Further, construction of project alternatives for cutoff walls could result in the introduction of contaminants into groundwater below construction locations. Because the locations of cutoff walls would not be located near other projects in the study area, the project would not contribute to a cumulatively significant impact on groundwater quality.

Wetlands and Other Waters of the U.S.

The cumulative context for impacts to wetlands and other waters of the U.S. include the project study area and areas with connectivity to the wetlands and other waters within the study area. Implementation of projects in the cumulative context would have similar effects as the project alternatives and result in significant cumulative impacts. Implementing any of the project alternatives would result in short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of in water closure structures, placement of fill, and elimination of existing vegetation in the receiving waters. Further, the project alternatives would include temporary impacts associated with fill and relocation of landside toe drains and irrigation ditches. Therefore, the contribution of the LSJR project to cumulative effects on wetlands and waters of the U.S. water would be considerable. Implementation of the avoidance, minimization and compensatory mitigation measures included in Section 5.7 would reduce the magnitude of the proposed project's contribution to this significant cumulative impact, but not to a less than considerable level; therefore, this cumulative impact would remain significant and unavoidable.

Air Quality

The cumulative context for air quality impacts is the SJVAPCD jurisdictional boundaries. All the related projects would cumulatively contribute to emissions of criteria pollutants in the region, particularly if they are constructed concurrently, which could have a significant cumulative effect on air quality. It is anticipated that each of these projects would implement their own mitigation plan to reduce the emissions to below the significance levels, but there is the potential for significant cumulative effects to remain. However, on a regional level, these projects would still contribute to a significant cumulative effect and coordination with the SJVAPCD would need to occur prior to construction to reduce these effects.

Construction of the proposed alternatives would result in a significant contribution to emissions of criteria pollutants. Implementation of mitigation measures to reduce construction criteria pollutants to below the regulatory thresholds, as described in Section 5.8, would reduce the LSJR project's contribution to less than considerable because they would reduce project emissions below CAA and CCAA thresholds. Therefore, the cumulative impact would be less than significant.

Greenhouse Gas Emissions

It is unlikely that any single project by itself could have a significant impact on the environment with respect to GHGs. Construction activity for the LSJR, considered on a project-only basis, would cause a temporary

and less than significant increase in GHG emissions. However, the cumulative effect of human activities has been linked to quantifiable changes in the composition of the atmosphere, which, in turn, have been shown to be the main cause of global climate change (IPCC 2007). Therefore, the analysis of the environmental effects of GHG emissions is inherently a cumulative impact issue. While the emissions of one single project will not cause global climate change, GHG emissions from multiple projects throughout the world could result in a cumulative effect with respect to global climate change.

It is expected that the primary impacts from these concurrent projects would be due to construction activities. On an individual basis, each of these projects would mitigate emissions below the general reporting threshold. If these projects are implemented concurrently, it is possible that the combined cumulative effects could be above reporting requirements for GHG emissions. However, with the implementation of mitigation measures, which would be required for each of these projects, it is possible that the effects could be reduced to less than significant. In addition, the majority of the related projects are FRM projects. By implementing these projects, the action agencies would be reducing potential future emissions associated with flood fighting and emergency actions. As a result, the related projects could combine to reduce long-term potential GHG emissions in the Lower SJR region. The overall cumulative GHG emissions from these projects are considered to be less than significant.

Vegetation and Wildlife

The cumulative setting for impacts on vegetation and wildlife in the Central Valley and Delta region include the vegetation, associated habitats and wildlife described in the cumulative projects above. It is anticipated that each of these projects would implement their own mitigation plan to reduce impacts to vegetation and wildlife; however, there is the potential for significant cumulative effects to remain. On a regional level, these projects would still contribute to a significant cumulative effect and coordination with regulatory agencies would need to occur prior to construction to reduce these effects. Implementation of the LSJR project has the potential to remove 25,508 lf of SRA up to a maximum of 51,985 lf; 142 acres up to 245 acres of riparian trees and shrubs; and 11 to 15 acres of wetlands, depending on alternative, within the project area. This is the case for FRM projects throughout the Central Valley. Over the past 200 years about 95 percent of the native riparian forests have been removed and the land within and adjacent to the riparian zone has been be converted to agricultural and urban uses. The LSJR project's contribution would be considerable and would contribute to a significant cumulative impact on vegetation and wildlife habitat. Implementation of the avoidance, minimization and compensatory mitigation measures included in Sections 5.9 and 5.10 would reduce the magnitude of the proposed project's contribution to this significant cumulative impact, but not to a less than considerable level; therefore, this cumulative impact would remain significant and unavoidable.

Mitigation measures included in Sections 5.9 and 5.10 would avoid, minimize and compensate to the extent feasible in accordance with the recommendations of the USFWS contained in their draft CAR for the LSJR project (Environmental Addendum). Further design refinements during the next phase of project development, together with investigations into the feasibility of a vegetation variance for the levees in the project area, would further reduce impacts on vegetation and wildlife. Potential adverse effects on vegetation and wildlife would remain significant due to the amount of habitat being removed to construct the project and the time lapse before the new plantings would mature to the level of those removed.

Fisheries Resources

Potential cumulative effects on fish would include effects associated with other levee, bank protection, dredging, water supply and ecosystem restoration projects proposed to occur in the SJR watershed. Projects underway both upstream and downstream of the LSJR project are intended to improve conditions for native fish and other aquatic organisms by improving habitat conditions within the existing system and by creating

additional habitat. Other projects are working to meet the State's co-equal goals for the Delta, balancing water supply reliability and ecosystem health. FRM projects in the valley include extensive levees, mostly immediately adjacent to the water bodies. These levees require on-going maintenance and repair and periodic improvements. Each of these activities may result in the direct degradation of nearshore habitat. In areas outside the Vegetation ETL VFZ or where a variance is approved, the riverbanks can be replanted and nearshore habitat conditions even improved over existing conditions. Most levee project proponents in the SJR watershed expressed the intent to seek a vegetation variance. With USACE approval of a vegetation variance, impacts to fish species from vegetation removal would be reduced but the cumulative impact would be significant.

The LSJR project would include the same kinds of impacts with the short- and long-term loss of SRA. The direct and indirect effects associated with construction of the LSJR project would result in a considerable contribution to cumulative impacts on fisheries. Implementation of the avoidance, minimization, restoration and compensatory mitigation measures in Section 5.7 would reduce the magnitude of the proposed project's contribution to this significant cumulative impact, but not to a less than considerable level; therefore, this cumulative impact would remain significant and unavoidable.

Special Status Species

The cumulative setting for impacts to special status species includes the spatial and temporal setting described for the species that correspond with the projects in the list above. The combination of the projects to each of the listed species affected by the LSJR project would result in significant cumulative impacts. The project alternatives would result in considerable contributions to direct and indirect effects on special status species. Implementation of the mitigation measures described for each species listed in Section 5.12 would reduce the project's impacts, except where there is direct and indirect loss of SRA habitat. This would not reduce the magnitude of the project's contribution to less than considerable levels; therefore, this cumulative impact would remain significant and unavoidable.

Potential cumulative impacts from the combination of these projects to each of the listed species affected by the LSJR project are discussed below. As described in Section 5.12, during preconstruction engineering and design, USACE designs will avoid impacts to special status species, where possible or otherwise minimize or compensate for adverse effects to each of these species.

Valley Elderberry Longhorn Beetle

Concurrent construction of multiple projects over the next 10 to 15 years within the LSJR study area would likely cause mortality to beetles due to construction operations. Construction activities for the multiple projects would occur each year during their flight season. Since construction activities would be adjacent to known VELB locations, it is likely that some mortality may occur. The exact number that would be injured or killed is unknown. No designated critical habitat would be affected with the construction of any of the projects.

Shrubs within each project footprint would be transplanted to appropriate conservation lands. These lands would be located as near to their currently locations as feasible. Additionally, compensation would be located at an approved mitigation bank. Transplanting of shrubs in the project vicinity, where feasible, would provide connectivity for the beetle. Lack of connectivity is a primary cause of the beetle decline and an important element in the recovery and sustainability for the beetle. The transplanting of shrubs and compensation through purchasing mitigation bank credits would offset effects to the beetle and a significant cumulative adverse effect or jeopardy to the VELB.

Salmon, Steelhead and Sturgeon

The proposed projects could adversely modify critical habitat or contribute to the loss or degradation of sensitive habitats in the project vicinity for listed species such as the Central Valley steelhead, Central Valley spring-run Chinook salmon, Delta smelt, Central Valley Fall-/late Fall-run Chinook salmon and green sturgeon. Erosion repair projects and dredging projects in the SJR system would reduce the sediment supply for downstream reaches. The LSJR project would not contribute to a reduction in the supply of sediment in the system; however, construction and operation of the closure structures on Fourteenmile Slough and Smith Canal could affect the distribution of the sediment in the system and change turbidity.

For projects approved for a vegetation variance, riparian vegetation, including vegetation that overhangs the water and contributes to SRA habitat values, would largely remain in place along the rivers and tributaries, except where removal is required for structural FRM features, like rock erosion protection. The RD 17 levee project would have initial cover losses due to project actions. However, the RD 17 levee improvement project would minimize vegetation removal through the choice of the type and method of improving the levees. The Lower SJR project would investigate the feasibility of a vegetation variance during the next project development phase. A vegetation variance could allow for most of the potential SRA overhanging vegetation canopy in the project area to remain, along with much of the woody vegetation on the lower one-half of the levee slopes and within the 15-foot easement adjacent to the waterside of the levee. Conceptual proposals for expansion of riparian habitat, including overhanging vegetation contributing to SRA along Paradise Cut and at upstream Federal wildlife refuges, would expand the availability of quality riparian habitat. In areas that have been approved or will be approved for a vegetation variance which would exclude the removal of SRA habitat, the effects would be considered less than significant for salmon, steelhead and sturgeon. Due to the scarcity and importance of SRA habitat values in the project area, complying with the Vegetation ETL would be considered a significant and unavoidable effect on habitat for salmon, steelhead and sturgeon.

Delta Smelt

The proposed projects would provide a mix of beneficial and adverse consequences to Delta smelt as explained for the other fish species. However, there are 4 specific, significant threats to the Delta smelt identified by USFWS: direct entrainments by State and Federal water export facilities, summer and fall increases in salinity and water clarity and effects from introduced species.

Implementation of the various projects would not affect direct entrainments by State and Federal water export facilities, although some, like the BDCP, intend to reduce entrainments by locating additional export facilities further north on the Sacramento River. Summer and fall increases in salinity is driven more by low flow drought years, water releases from the dams on the SJR system and agricultural return flows. Summer and fall increases in water clarity are associated with, among other factors, invasive nonnative clam species and nonnative plant species, which are generally located in the Delta, including the northernmost part of the project areas. These nonnative invasive clams filter out vital chlorophyll and plankton that would normally increase turbidity, which helps the Delta smelt avoid predators. However, as mentioned above, the erosion repair activities of these combined projects, would likely reduce the sediment supply for riverine reaches directly downstream because the erosion repair is holding the bank or levee in place. Shallow water habitat is also a very important component for Delta smelt spawning and implementation of the various projects has the potential to have a **significant** effect on the Delta smelt's shallow water habitat in the project area.

Giant Garter Snake

The GGS could be affected by multiple projects being constructed within the LSJR project area during the next 10 to 15 years. Primarily, habitat loss would occur on the RD 17 area as a result of land conversion from agricultural and open space to urban uses. In association with the structural elements of the FRM project, short-term impacts would occur for a single construction season along haul routes and within borrow sites. To minimize potential impacts, work within GGS habitat would be conducted between May 1 and October 1, when snakes are active and can move out of the construction area. Snake mortality could occur during construction along haul routes; however, the snakes are mobile and would likely move out of the way from construction equipment. Avoidance and minimization measures described in Section 5.12.10.1 would reduce impacts on GGS to a less than significant level. The USFWS has recommended the avoidance and minimization measures for GGS based on BMPs shown to reduce impacts to the snake.

Land Use

The cumulative setting for impacts to land use is the Cities of Stockton, Lathrop, Manteca and San Joaquin County. Construction of any of the proposed alternatives, especially the setback levee along Fourteenmile Slough and the setback levee in RD 17, would result in the conversion of some land use types, including agricultural lands, into levees and supporting FRM features. Construction and/or implementation of all projects within the these areas, as provided in the list above, including the RD 17 Phase 3 levee project and the build out of the Stockton, Manteca and Lathrop general plans. This would result in the irreversible conversion of farmland to urban development, which would be a significant cumulative impact. While the LSJRFS project would implement mitigation measures to reduce the effect from this project to less than significant, there would remain a significant cumulative effect to agriculture in the region.

Implementing the LSJR project would not result in a cumulative loss of urban lands, which are increasing in the region. The LSJR project would comply with Federal and State regulations to compensate the landowners for the loss of their properties (urban and agricultural) and to relocate them, as feasible.

Permanent loss of SRA would conflict with the San Joaquin Habitat Conservation Plan and for this reason the project would have a considerable contribution. Because there are no feasible mitigation measures to mitigate the project's contribution to less than considerable, the impact remains significant and unavoidable. The NEPA consideration of the project's contribution to cumulative losses of SRA is considered under "Vegetation and Wildlife," "Fisheries Resources," "Special Status Species" and "Salmon, Steelhead and Sturgeon."

Transportation

The cumulative setting for impacts to transportation is the transportation network in the study area. Projects planned in the study area constructed at the same time as the LSJR Project could contribute to short-term increases in construction-related vehicle trips and disruptions of traffic patterns. While there would be a cumulative effect on freeways and other regional roadways, the roadways are designed to handle increased traffic loads. The LSJR project would not contribute to significant cumulative impacts on traffic or transportation in the vicinity because there is enough distance between the LSJR project and the other projects that the effects would not combine and there would be no cumulative impact.

Utilities and Public Infrastructure

The cumulative setting for utilities and public infrastructure include the Cities of Stockton, Lathrop, Manteca and areas within the project area served by utilities in San Joaquin County. Implementation of projects in the list above would result in increased demand on local utilities in the study area. Utilities planning and implementation of capital improvement projects, in concert with the development these projects, would reduce impacts on service. However, development of these projects would have potential significant cumulative impacts related to the expansion and service from utilities. Implementation of the proposed LSJR alternatives would not require the use or expansion of local utilities, including water supply. The project would have the potential to damage utility lines during construction that could interrupt supply. This would result in a considerable contribution to cumulative impacts.

Implementation of the mitigation measures in Section 5.16 would reduce the project's contribution to less than significant because the construction contractor would coordinate with utility service providers and consumers to minimize interruptions to the maximum extent feasible and a response plan to address service interruptions would be prepared and implemented. Therefore, by incorporating mitigation measures, the LSJR project would not contribute to significant cumulative impacts on utilities and public infrastructure.

Recreation

The cumulative setting for recreation in the project study area would be combined with other construction projects that could occur during the same timeframe as the alternatives considered in this study. At the time of this analysis, heavy construction projects are anticipated to occur along the north, west and south levees of RD 17. Temporary construction effects from the LSJR project would be minimized through replacement with similar facilities, design modifications and coordination with the public and recreation agencies ensuring that any residual effects would be minimized. However, LSJR project impacts associated with the loss of trees and shrubs (changes in the visual quality of the recreational experience, changes in microclimate and reduced opportunities for bird watching and wildlife viewing) would result in a considerable contribution to significant cumulative impacts on recreation. Because there are no feasible mitigation measures to reduce the magnitude of the project's contribution to less than considerable, this cumulative impact would remain significant and unavoidable.

Noise

The cumulative setting for impacts related to noise is based on other local projects that would result in temporarily increased levels of ambient noise in the study area. In residential areas along the rivers and creeks, this would be a significant effect on those residents. However, the effects would be limited to the people or wildlife in the immediate proximity to the construction sites. None of the local projects are in close enough proximity of the individual construction sites in the project area to create a cumulative effect from concurrent construction. If there are any projects constructing within audible distance from one another, USACE would coordinate with the other projects to ensure that the LSJR project would not be constructing at the same time as other, adjacent construction. The LSJR project would not contribute to a significant cumulative impact because the project noise impacts from the project would be site specific and would not combine with other projects' noise impacts.

Public Health and Environmental Hazards

There is a potential for the proposed project as well as projects identified above to encounter hazardous materials or to experience an unintended release of such materials, resulting in an increased risk of exposure. Exposure to existing soil and groundwater contamination is generally site-specific and depends on past, present and future uses and existing soil, sediment and groundwater conditions. Any hazardous materials

uncovered during construction activities would be managed consistent with applicable Federal, State and local laws to limit exposure and clean up the contamination. While construction and operational activities could result in accidental spills or leaks in the vicinity, the extent of the contamination is not likely to extend beyond the project site boundaries due to the type and limited quantities of hazardous materials likely to be used (e.g. motor fuels, hydraulic oils, paint and lubricants). Furthermore, the storage, handling and transport of hazardous materials are also regulated by Federal, State and local regulatory agencies to limit risk of exposure. Therefore, the proposed project is not expected to contribute to a significant cumulative impact from exposure to existing contamination or from release of hazardous or toxic materials during construction.

Cultural

Cumulative impacts to cultural resources would be primarily related to other construction projects that could occur during the same timeframe as those considered for this study and within the same vicinity as this study. At the time of this analysis, there are several heavy construction projects anticipated to modify the SJR levees that would result in similar impacts to cultural resource sites as the LSJR project. Construction activities, including those associated with the LSJR Project, could contribute to the progressive loss of cultural resources and result in significant cumulative impacts. The project's contribution to this cumulative impact would be considerable due to the amount of earth-disturbing activities associated with project construction. Implementation of the mitigation measures in Section 5.21 for development and implementation of an HPTP would reduce the proposed project's contribution to this significant cumulative impact, but not to a less than considerable level. Therefore, this cumulative impact would remain significant and unavoidable.

The mitigation measure in Section 5.21 requires development of specific measures in accordance with the PA to address any adverse effects on historic properties via the development of an HPTP that would guide the level of data recovery, mitigation or actions taken to resolve adverse effects to the historic property.

Aesthetics

The cumulative setting for aesthetics would be site specific to those areas in or adjacent to the project study area. Implementation of projects within the study area in the past, together with those planned in the future, would result in significant cumulative impacts to visual resources primarily related to loss of visual quality both during construction and after construction. The proposed alternatives would contribute to this significant cumulative impact because it would result in a permanent loss of large trees and other vegetation along the Lower SJR, Lower Calaveras River, French Camp Slough, Mosher Slough, Fourteenmile Slough, Tenmile Slough and Fivemile Slough. Other projects in the area, such as the RD 17 Levee Improvement Project, could also result in the removal of large trees and other vegetation. Therefore, the LSJR project would result in a considerable contribution to cumulative impacts on visual resources, primarily from removal of vegetation and the long time period for replanted vegetation to reach similar size. Because there are no feasible mitigation measures to reduce the magnitude of the project's contribution to less than considerable, this cumulative impact would remain significant and unavoidable.

5.24 UNAVOIDABLE SIGNIFICANT ENVIRONMENTAL EFFECTS

Certain adverse impacts cannot be avoided with the application of mitigation measures. State CEQA Guidelines CCR Section 21100(b)(2)(A) provides that an EIR shall include a detailed statement setting forth "any significant effect on the environment that cannot be avoided if the project is implemented." Sections 5.1 to 5.21 provide a detailed analysis of all potentially significant direct and indirect environmental impacts of the LSJR project, feasible mitigation measures that could reduce or avoid the project's significant impacts and whether these mitigation measures would reduce these impacts to less than

significant levels. The LSJR project's significant cumulative impacts are in Section 5.23. If a specific impact cannot be reduced to a less than significant level, it is considered a significant and unavoidable impact. The significant and unavoidable environmental impacts (direct, indirect and/or cumulative) of the preferred alternative (RP), Alternative 7a, are shown in Table 5-48.

Table 5-48: Significant and Unavoidable Environmental Impacts of the RP, Alternative 7a

Resource	Effect
Vegetation	Short- and long-term loss of trees, shrubs and wetlands in the project area.
Wildlife	Short- and long-term loss of habitat and movement corridors in the project area.
Fisheries	Indirect effects to fish habitat from the removal of some vegetation from the levee slopes and vibration during construction. Direct effects from the construction and operation of closure structures on Fourteenmile Slough and Smith Canal. Indirect effects of the closure structures due to the potential to attract non-native predators.
Special Status Species	Local loss of riparian, wetland and shaded riverine aquatic habitat.
Recreation	Impacts to the recreational experience due to vegetation removal and the resulting changes in the visual quality, microclimate and reduced opportunities for bird watching and wildlife viewing.
Aesthetics	Loss of visual character and loss of visual quality of the site and surroundings. Removal of trees and shrubs for compliance with the Vegetation ETL would unavoidably impact aesthetics. If a variance to the vegetation ETL is approved, this impact would be reduced but not to less than significant. The Smith Canal closure structure and the wall along Dad's Point would also be a significant and unavoidable impact.
Transportation	Because haul routes are unknown at this time, the magnitude of impacts to transportation and circulation during construction activities cannot be quantified; therefore, even with mitigation measures impacts would remain significant and unavoidable.
Noise	Short-term construction impacts related to noise and vibration may affect sensitive receptors in and adjacent to the construction sites and haul routes. Also, predicted noise levels may not meet the applicable standards for local exterior noise for residential land uses.
Cultural Resources	Short- and long-term construction impacts to cultural resources and historic properties from construction of levee improvements, new levees, seepage berms and closure structures.

5.25 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA requires that an EIS include a discussion of the irreversible and irretrievable commitments of resources that may be involved should the project be implemented. Similarly, the State CEQA Guidelines require a discussion of the significant, irreversible environmental changes that would be caused by the project should it be implemented. The irreversible and irretrievable commitments of resources are the permanent loss of resources for future or alternative purposes. Irreversible and irretrievable resources are those that cannot be recovered or recycled or those that are consumed or reduced to unrecoverable forms. Project implementation would result in the irreversible and irretrievable commitments of energy and material resources during project construction and maintenance, including the following:

- Construction materials, including such resources as soil and rocks;
- Land and water area committed to new/expanded project facilities;
- Energy expended in the form of electricity, gasoline, diesel fuel and oil for equipment and transportation vehicles that would be needed for project construction, O&M; and
- Water used for dust abatement.

The use of these nonrenewable resources is expected to account for only a small portion of the region's resources and would not affect the availability of these resources for other needs within the region. Construction activities would not result in inefficient use of energy or natural resources.

As described throughout this FR/DEIS/DEIR, without implementation of the LSJR project, the risk of levee failure would remain high. While a precise quantification of environmental impacts associated with potential levee failure is not possible, there is a potential for a variety of significant environmental impacts. Levee failure and the resulting emergency and reconstruction efforts could expend more energy, overall, than construction of the LSJR project. A large volume of debris would result from a flood event, such as cars, appliances, housing materials and vegetation. They would all be generated with a flood and would likely have to be disposed of in a landfill. After debris removal was completed, re-building would occur and new materials would be required to construct homes, businesses, roads and other urban infrastructure. Thus, project implementation preempts potentially substantial future consumption and is likely to result in long-term energy and materials conservation.

5.26 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

NEPA requires that an EIS include a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. Within the context of this FR/EIS/EIR, "short-term" refers to the construction period, while "long-term" refers to the operational life of the project and beyond.

Project construction would result in short-term construction-related effects such as interference with local traffic and recreation facilities and increased air emissions, ambient noise level, dust generation and are not expected to alter the long-term productivity of the natural environment. Project implementation would also result in long-term effects, including permanent loss of riparian vegetation, habitat for fish and wildlife, changes to Waters of the United States and loss of visual resources.

Project implementation would contribute to long-term productivity of the environment by improving the FRM system, including levees and closure structures, that protects North and Central Stockton and thereby reducing the overall flood risk to residential, business and government buildings and infrastructure. This would reduce flood-related risks to human health and safety and to important infrastructure. The long-term beneficial effects of the project would outweigh its potentially significant, short-term impacts to the environment.

CHAPTER 6 — COORDINATION AND CONSULTATION

This chapter summarizes public and agency involvement undertaken by USACE, CVFPB, and SJAFCA that were conducted to date, are ongoing, and/or will be conducted for this project and that satisfy NEPA and CEQA requirements for public scoping and agency consultation and coordination. Additionally, consultation with Native American Tribes is described.

6.1 PUBLIC INVOLVEMENT UNDER NEPA AND CEQA

This section describes key elements of the public involvement process for this feasibility study. This report was prepared as an integrated FR/EIS/EIR.

6.1.1 NOTICE OF INTENT, NOTICE OF PREPARATION, AND SCOPING MEETINGS

A NOI for preparation of a joint EIS/EIR was published in the Federal Register on January 15, 2010 (Vol. 75, No. 10). A NOP was filed with the State Clearinghouse (SCH # 2010012027) on the same date. USACE is the lead agency for the EIS and for NEPA compliance. SJAFCA is the lead agency for the EIR and for CEQA compliance.

A public scoping meeting was held at the University of the Pacific on Wednesday, January 27, 2010. Scoping comments received at the public meeting and during the scoping period are included in Environmental Addendum. In addition to requests to be added to the study mailing list, scoping comments included the following broad requests and recommendations:

- Include Stewart Tract and Paradise Cut within the focused study area.
- Evaluate dredging and levee height raises as measures to improve channel capacity and FRM.
- Incorporate measures to minimize adverse effects on fish, wildlife and their habitat.
- Incorporate measures to improve or restore fish and wildlife habitat.
- Use existing data, modeling and analyses developed by others where feasible.
- Evaluate potential impacts on infrastructure adjacent to and/or spanning the waterways.
- Evaluate potential impacts on fish, wildlife, special status species, habitat, vegetation, wetlands, water quality, river flows, channel alignment, floodplains, climate change, air quality, socioeconomics, land use, growth inducement and cumulative impacts.
- Describe the relationship of the project to other large scale planning for the Delta and San Joaquin.

Measures for FRM were evaluated as part of this study. Plan formulation and measure screening are described in Chapter 3. Measures to reduce and minimize impacts on fish, wildlife and their habitat were analyzed and are described in Chapter 5. The purpose of this study is FRM, therefore measures focused solely on ecosystem restoration were eliminated early in the study; however, opportunities to incorporate environmentally beneficial measures into FRM alternatives were more fully considered. The levee setback along Fourteenmile Slough provides opportunities to integrate compensatory mitigation into the (RP). Impact assessment for all of the resources identified during scoping are included in Chapter 5.

6.1.2 NEXT STEPS IN THE ENVIRONMENTAL REVIEW PROCESS

A Notice of Availability of the draft report was published in the Federal Register on February 27, 2015, and circulated for a 45-day public review period to Federal, State and local agencies, organizations and individuals who have an interest in the project. One public workshop was held during the review period to provide additional opportunities to discuss and comment on the draft report. The public workshop was held on Wednesday, April 8, 2015 at the Stockton Civic Auditorium, South Hall, 525 North Center Street, Stockton, CA from 6:00 to 8:00 p.m. All comments received during the public review period were considered and incorporated into the final report, as appropriate. Public comments and the USACE/CVFPB/SJAFCA responses to those comments are included in Environmental Addendum.

A Notice of Availability of the final report for a 30-day State, agency, and public review period will be published in the Federal Register. All comments received during this period will be considered prior to USACE making a final decision on the RP and in preparing the ROD.

6.2 COORDINATION WITH OTHER FEDERAL, STATE, REGIONAL AND LOCAL AGENCIES

Chapter 7 describes how the project complies with applicable Federal, State and local laws, regulations, and other requirements and discusses required consultations and coordination. The following briefly summarizes these consultation and coordination efforts.

Beyond formal public scoping, USACE, SJAFCA, and DWR communicated with Federal, State and local agencies in the course of project planning, alternative development and preparation of this report. These communications included in-person meetings, telephone conversations and written correspondence. The communications addressed consistency with other planning studies and projects in the region, pursuit of agency approvals, information to be considered in the document and opportunities for partnership.

USACE coordinated and informally consulted with USFWS and NMFS during the study to help analyze potential effects to biological resources, including threatened and endangered species. In their Draft Fish and Wildlife Coordination Act Report (2014), USFWS provided the recommendations shown in Section 6.2.1 below. USACE's response to each recommendation is also provided.

This report was coordinated with the State Historic Preservation Officer (SHPO) among the project partners (USACE, CVFPB, SJAFCA) and with DWR. Coordination with SHPO was conducted during the early planning phase of this study. A current Programmatic Agreement has been signed by USACE and was coordinated with SHPO.

6.2.1 U.S. FISH AND WILDLIFE SERVICE RECOMMENDATIONS

A Draft Coordination Act Report (CAR), dated June 24, 2014, and a Final CAR, dated July 25, 2016, were prepared by USFWS in coordination with CDFW (See Environmental Addendum). The CAR describes existing environmental resources within the project area and potential effects of the project on these resources. Recommendations developed by the USFWS in the CAR were considered in plan formulation and mitigation development.

For the proposed LSJRFS, USFWS recommends USACE:

USFWS Recommendation 1: Resolve uncertainties and information gaps in the study.

1.1. Determine vegetation impacts and future allowances in all project locations with certainty, prior to construction.

1b. Comprehensively evaluate the effects of tidal gate operation on salinity, flow, temperature, other water quality factors, and all relevant ecological processes and related recreational activities, in the affected sloughs and adjacent waterways; this should include analysis for reasonable sea level rise predictions over the project life.

1.2. Conduct ground-level assessment of vegetation losses, including, but not limited to, cover typing, species, height, diameter, substrate and inundation frequency; and a habitat evaluation procedures study, if deemed appropriate by USFWS.

1.3. Develop and propose mitigation to offset habitat losses, using the guidance provided in this report, with exact locations and quantities of all mitigation plantings, and plans for monitoring.

1.4. Complete a quantitative assessment of impacts for the preferred alternative.

1.5. Identify staging and borrow areas.

Response 1: Concur in part. As part of USACE Planning Modernization, some of the specific information previously developed during the feasibility phase of a project is either not developed, or is developed during later project phases only for the RP. The simplifying assumptions and analytical methods used to quantify impacts are likely to overestimate actual environmental impacts to fish and wildlife habitat. However, the level of information developed at the Draft FR/EIS/EIR stage is sufficient to discern the relative differences in the impacts between alternatives to inform the decision making process and satisfy NEPA and CEQA requirements. Since the draft report was published, field surveys for VELB and GGS habitats were completed and that habitat was identified and quantified.

Response 1.1: Concur. Prior to construction, vegetation impacts and future approved vegetation allowances would be specifically determined for the RP. This would include onsite vegetation surveys.

Response 1.1b: Concur. During PED, engineering modeling and studies would be completed to support detailed designs, operational criteria, and minimization of environmental effects.

Response 1.2: Concur. During PED, field surveys would be completed to refine estimates of vegetation loss. The scope of these surveys would be coordinated with USFWS, NMFS and CDFW. If appropriate, a habitat evaluation procedure study would be completed.

Response 1.3: Concur. Mitigation that would avoid, minimize, rectify or compensate for potential adverse impacts is identified in this report. A mitigation and monitoring plan related to habitat elements has been developed for the RP. The plan will be coordinated with USFWS, NMFS and CDFW, and is included as an addendum to the final report.

Response 1.4: Concur. Chapter 5 of this report includes an assessment of impacts for all alternatives.

Response 1.5: Concur. Chapter 4, Section 4.5 generally describes staging and borrow areas needed to implement the alternatives included in the final array. Staging and borrow areas would be specifically identified and evaluated during PED.

USFWS Recommendation 2: Evaluate and consider the following alternative measures to avoid impacts, and locate mitigation sites as near to the impact sites as possible before going off-site to approved conservation banks:

2.1. Eliminate the proposed tidal gates, especially the one on Fourteenmile Slough, and instead improve the slough levees, as a means to avoid impacts of gate operations to tidal habitat function;

2.2. Restore the historic wetland between Walther and French Camp Sloughs, including removal of capped landfill material;

2.3. Create tidal wetland as near as possible to impact sites on Shima, Wright, and/or Rindge Tract lands;

2.4. Create SRA and riparian cover as near as possible to impact sites on candidate areas identified on French Camp Slough north bank (Van Buskirk golf course) and the lower Calaveras River south bank (existing set back levee area);

2.5. Develop an alternative for RD 17 phase III improvements that combines a setback levee with restoration of SRA cover to the maximum extent possible.

Response 2.1: Do not concur. The tide gates are an integral part of the RP. Modifications to the levee in this area is constrained by the proximity of homes and urban infrastructure.

Responses 2.2., 2.3., and 2.4: Concur in part. During PED, additional opportunities to implement cost effective, feasible, and acceptable compensatory mitigation on site and near the project site, instead of off-site, would be evaluated.

Response 2.5: Do not concur. The RP would implement a project in the North and Central Stockton area. Improvements in RD 17 are not included in the RP identified in this interim feasibility study.

USFWS Recommendation 3: Develop an operations and maintenance manual for completed project features to provide maximal habitat value conditions consistent with any approved ETL variance, other maintenance standards needed for project reliability and safety, and the USFWS' and NMFS' Biological Opinions. This may include measures such as selective removal of non-natives and planting of natives.

Response 3: Concur in part. The operations and maintenance manuals for the project would be updated to include the new features and their operation and maintenance, including any vegetation management requirements, and requirements of the USFWS and NMFS BO's. If an ETL vegetation variance is approved, non-native trees and shrubs would be selectively removed and native trees and shrubs may be planted during and immediately following construction and maintained during the approved establishment period. Following this, routine O&M would remove both native and non-native tree and shrub seedlings before they become established.

USFWS Recommendation 4: Reinitiate Section 7 consultation with USFWS and NMFS as appropriate for any changes in the project description, including but not limited to development of a mitigation plan.

Response 4: Concur. Section 7 consultation would be reinitiated consistent with the requirements specified in 50 CFR 402.16.

USFWS Recommendation 5: Conduct appropriate consultation with CDFW on effects to State-listed species.

Response 5: Concur. USACE has consulted with CDFW under the FWCA. SJAFCA as CEQA lead agency, and CVFPB as a responsible agency, are consulting with CDFW, as appropriate, on potential project effects to State-listed species.

USFWS Recommendation 6: Develop enhancement and restoration opportunities for incorporation to the maximum extent possible into the preferred alternative for the project.

Response 6: Concur. Opportunities for restoration were considered during plan formulation; however, opportunities to incorporate ecosystem restoration into the preferred alternative are severely constrained due to the proximity of the levee system to the waterways and the highly urbanized Stockton area. Therefore, restoration actions are not included in the RP. The RP does incorporate some compensatory mitigation features along Fourteenmile Slough.

6.3 CONSULTATION WITH NATIVE AMERICAN TRIBES

A list of potentially interested Native Americans was obtained from the District Native American Coordinator at Caltrans District 10 in Stockton. Two letters were sent to the Ione Band of Miwok Indians, the Buena Vista Rancheria of Me-Wuk Indians, the Wilton Rancheria, the Nototomne/Northern Valley Yokuts and the California Valley Miwok Tribe.

The first letter, dated August 12, 2012, informed them of the new feasibility study and requested any information they may have on areas of traditional cultural interest to their tribal members. We had two responses. Ms. Sylvia Burley, Tribal Chairperson of the California Valley Miwok Indians, requested Government to Government consultation which was forwarded to Mr. Mark Gilfillan, the USACE Tribal Liaison. Ms. Katherine Perez, Tribal Chairwoman for the Nototomne/Northern Valley Yokuts, called to request more information.

The first letters were sent out on December 2, 2013, including a description, location maps of the final array of alternatives, and a copy of the draft PA for review. A call from Mr. Randy Yonemura concerning the PA was received in December 2013; however, no specific comments have been submitted by any Tribe.

Since the first letters were sent out, USACE developed a revised draft PA for the project. A second round of letters were sent on March 18, 2016 with a copy of the revised draft PA for review. No comments were received from the Tribes regarding the revised draft PA.

A final draft of the PA was distributed to tribes on August 13, 2014. In response, a letter from the California Valley Miwok Tribe stating they had no further comments and were requesting concurring party status was received on August 15, 2014. Ms. Perez called USACE for additional information, stated that she was very concerned about the possibility of human burials within the project area, and requested concurring party status. She chose to sign the final draft form of the document and submitted it via facsimile on August 20, 2014. USACE received comments concerning the project and PA from the Buena Vista Rancheria on August 29, 2014. USACE has provided the Buena Vista Rancheria responses to their comments in May 2016.

The United Auburn Indian Community expressed interest in this project on November 23, 2015 and have since been included in consultations.

The Draft FR/EIS/EIR was provided, and the Final Integrated Report will be provided to, the following Tribes: Wilson Rancheria, Nototomne/Northern Valley Yokuts, Californian Valley Miwok Tribe, Ione Band of Miwok Indians, United Auburn Indian Community, and Buena Vista Rancheria Me-Wuk Indians.

A current PA has been signed by USACE and SHPO on May 11, 2016 as part of the submittal of this document.

6.4 ISSUES OF KNOWN OR EXPECTED CONTROVERSY

The following issues were identified as a result of public scoping during the feasibility study and preparation of the EIS/EIR. While these issues are addressed in the EIS/EIR, they are of continuing concern to the public.

6.4.1 PROPERTY ACQUISITION

A specific issue of concern involves potential conflicts with private property within or near the construction area. In some cases, permanent property acquisition may be needed for project construction, O&M. Temporary construction easements will likely be needed for construction staging and equipment access, and temporary restrictions on access to private property may also be necessary. These effects are described in Chapter 5.

6.4.2 CONSTRUCTION-RELATED EFFECTS

The levee system in the project area is adjacent to residential areas and other developed land uses. Construction activities are likely to result in construction-related effects including topics of noise, traffic and air quality, and are specifically described in Chapter 5.

6.4.3 LEVEE ENCROACHMENT AND VEGETATION

The project is likely to include removal, relocation or replacement of features in, on or under the levee or adjacent O&M corridors such as structures, pipelines, walls, stairs, utilities and other elements such as vegetation.

USACE technical guidance for levee vegetation management is published in USACE ETL 1110-2-583. Implementation of this guidance has stirred controversy throughout the Central Valley since cursory assessments have shown that much vegetation may require removal, resulting in effects on fish and wildlife habitat including habitat for endangered and threatened species, and social values like recreation and aesthetics. This issue is described further in Chapter 5 in the sections on vegetation, fisheries, wildlife, special status species, visual resources and recreation.

6.4.4 EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT

Application of the EO to this study caused concerns about the ability of local jurisdictions to meet their planning and development goals. This concern is particularly relevant to the RD 17 portion of the project area. The project's potential to induce growth, or remove a potential barrier to growth, is discussed in Chapter 3, Section 3.6.

CHAPTER 7 — COMPLIANCE WITH APPLICABLE LAWS, POLICIES AND PLANS

The laws, regulations, policies and plans related to the resources discussed in Chapter 5 are summarized herein. The LSJRFS compliance status is also discussed.

7.1 FEDERAL REQUIREMENTS

7.1.1 CLEAN AIR ACT

The Federal CAA (42 USC Section 7401, *et seq.*) authorized the establishment of national health-based air quality standards, and also set deadlines for their attainment. The CAA Amendments of 1990 (1990 CAA) made major changes in deadlines for attaining NAAQS. State and local agencies, within areas that exceed the NAAQS, are required to develop SIPs to show how they will achieve the NAAQS for nonattainment criteria pollutants by specific dates. SIPs are not single documents. They are a compilation of new and previously submitted plans, programs (such as monitoring, modeling, permitting, etc.), district rules, State regulations and Federal controls. USEPA is responsible for enforcing the NAAQS primarily through reviewing SIPs that are prepared by each state. As required by the Federal CAA, USEPA established and continues to update the NAAQS for specific criteria air pollutants: O3, CO, NO2, SO2, PM10, PM2.5, and Pb. Pursuant to CAA Section 176(c) requirements, USEPA promulgated the General Conformity Rule (40 CFR Part 93), which applies to most Federal actions including the LSJRFS. The General Conformity Rule is used to determine if Federal actions meet the requirements of the CAA and the applicable SIP by ensuring that pollutant emissions related to the action do not:

- Cause or contribute to new violations of a NAAQS.
- Increase the frequency or severity of any existing violation of a NAAQS.
- Delay timely attainment of a NAAQS or interim emission reduction.

A conformity determination under the General Conformity Rule is required if the Federal agency determines: the action will occur in a nonattainment or maintenance area; that one or more specific exemptions do not apply to the action; the action is not included in the Federal agency's "presumed to conform" list; the emissions from the proposed action are not within the approved emissions budget for an applicable facility; and the total direct and indirect emissions of a pollutant (or its precursors) are at, or above, the *de minimis* levels established in the General Conformity regulations.

For the LSJR Project, emissions from both construction equipment and barges, as well as those associated with construction of slurry walls, bank protection and levee raises were analyzed to determine air quality impacts. The analysis determined that the emissions associated with construction would be above *de minimis* levels. However, emissions would be reduced to below *de minimis* thresholds with the implementation of mitigation measures as described in Section 5.8. A General Conformity determination is therefore not required and the Project is in compliance with the CAA.

GHG emission management is regulated by Federal, State and local levels of government. USEPA is responsible for GHG regulation at the Federal level. On December 7, 2009, the Final Endangerment and Cause or Contribute Findings for Greenhouse Gases (endangerment finding) under Section 202(a) of the CAA went into effect. The finding states that current and projected concentrations of the six key GHGs threaten the public health and welfare of present and future generations. Furthermore, the combined emissions of these GHGs from new motor vehicles contribute to the GHG pollution, which threatens public health and welfare (USEPA 2012a). Under the endangerment finding, USEPA is developing vehicle emission standards under the CAA. Greenhouse Gases under Section 202(a) of the CAA determine whether

project emission sources and levels significantly affect air quality based on Federal standards established by USEPA and State standards set by CARB. The LSJR Project is estimated to be beneath the reporting limits for GHGs. As a result, the Project is considered in compliance with the CAA.

7.1.2 CLEAN WATER ACT

CWA is the primary Federal law governing water pollution. It established the basic structure for regulating discharges of pollutants into waters of the U.S. and gives USEPA authority to implement pollution control programs such as setting wastewater standards for industries (USEPA 2002). In some states, such as California, USEPA has delegated authority to regulate the CWA to State agencies.

Section 401 of the CWA regulates the water quality for any activity that may result in discharge into navigable waters; these actions must not violate Federal water quality standards. The Central Valley RWQCB administers Section 401 in California and either issues or denies water quality certifications that typically include project-specific requirements established by the RWQCB.

Section 404 of the CWA requires that a permit be obtained from USEPA and USACE when an action will result in discharge of dredged or fill material into wetlands and waters of the U.S. Under Section 404, USACE regulates such discharges and issues individual and/or general permits. Before USACE can issue a permit, it must determine that the project is in compliance with the CWA Section 404(b)(1) guidelines, which specify that "no discharge of dredged or fill material shall be permitted if there is a practical alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 CFR 230.10[a]). USEPA has "veto" authority over permits issued by USACE.

When conducting its own civil works projects, USACE does not issue permits to itself. Rather, USACE complies with the guidelines and substantive requirements of the CWA, including Section 404 and Section 401. The LSJR Project would require discharge of fill material into waters of the U.S.; therefore, a section 404(b)(1) analysis was conducted on the Recommended Plan (RP). The discharge of fill material would comply with 404(b)(1) guidelines with the inclusion of appropriate measures to minimize pollution or adverse effects on the aquatic ecosystem. A Section 401 water quality certification will be requested from the Central Valley RWQCB. With the completion of a 404(b)(1) analysis and the issuance of a Section 401 water quality certification from the Central Valley RWQCB, this project would be in full compliance with the CWA.

The Project would also require a NPDES permit since it would disturb 1 or more acres of land and involves possible storm water discharges to surface waters. Prior to construction, the contractor would prepare a SWPPP and then submit a NOI to the Central Valley RWQCB requesting approval of the proposed work. This storm water plan would identify best management practices to avoid or minimize any adverse effects of construction on surface waters. Once the work is completed, the contractor would submit a Notice of Termination to terminate coverage by the NPDES permit.

7.1.3 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

The Comprehensive Environmental Response, Compensation and Liability Act (known as Superfund) was passed to facilitate the cleanup of toxic waste sites. In 1986, the Act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership. HTRW materials may be present in the project vicinity. The NFS is responsible for providing all lands, easements and rights-of-way required for the LSJR Project. If contaminants exist, these lands would be

required to be cleaned up before project implementation. The LSJR Project would be in full compliance with this Act.

7.1.4 FEDERAL ENDANGERED SPECIES ACT OF 1973, AS AMENDED

Pursuant to the ESA, USFWS and NMFS have regulatory authority over Federally-listed species. Under the ESA, a permit to "take" a listed species is required for any Federal action that may harm a listed species. ESA, Section 7 prohibits Federal agencies from authorizing, funding or carrying out activities that are likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its critical habitat. By consulting with USFWS and NMFS before initiating projects, agencies review actions to determine if they could adversely affect listed species or their habitat and design their programs and projects to conserve listed and proposed species. USFWS and NMFS coordination with other Federal agencies is important to species conservation. USFWS is the administering agency for non-marine species. NMFS is the administering agency for marine species, including anadromous fish species.

USACE submitted to USFWS and NMFS a biological assessment and requested to formally consult on the RP's potential effects on Federally-listed, threatened and endangered species, and designated critical habitat. Formal consultation with USFWS and with NMFS concluded with biological opinions (BO), issued in June 2016, which included incidental take statements and non-discretionary terms and conditions. The consultation addressed the following: VELB, GGS, North American green sturgeon southern DPS, Delta smelt, California Central Valley (CV) steelhead DPS, CV spring-run Chinook salmon evolutionarily significant unit (ESU), and designated Critical Habitat for Central Valley Steelhead DPS, Delta smelt, and green sturgeon southern DPS. With receipt of the BOs the LSJR Project is in full compliance with Section 7 of the Act. The BOs and supporting information are included in Environmental Addendum.

7.1.5 EO 11990, PROTECTION OF WETLANDS

Executive Order 11990, signed May 24, 1977, directs all Federal agencies to refrain from assisting in or giving financial support to projects that encroach on publicly or privately owned wetlands. It further requires that Federal agencies support a policy to minimize the destruction, loss or degradation of wetlands. A project that encroaches on wetlands may not be undertaken unless the agency determines that: 1) there are no practicable alternatives to such construction, 2) the project includes all practicable measures to minimize harm to wetlands that would be affected, and 3) the effect would be minor.

As part of the Feasibility Study, a full range of measures and alternatives to achieve FRM were developed and assessed. The RP includes elements that would impact waters of the U.S., including wetlands. These project elements are the two closure structures on Fourteenmile Slough and Smith Canal; and relocation of landside toe drains and some local irrigation and drainage ditches in order to construct levee improvements. During the next project development phase, all jurisdictional wetlands potentially affected by the project would be identified and delineated in the field. Avoidance and minimization measures would be implemented to the maximum extent feasible. All impacts to wetlands would be fully mitigated through a combination of onsite or offsite compensatory mitigation and mitigation bank credits. Once wetlands have been identified, delineated and avoidance, minimization and compensation measures implemented, the will be in compliance with EO 11990.

7.1.6 EO 12898, ENVIRONMENTAL JUSTICE

EO 12898 requires that environmental analyses of proposed Federal actions address any disproportionately high, adverse human health or environmental effects on minority or low-income communities. Federal agencies' responsibility applies equally to Native American populations. Each Federal agency must ensure that public documents, notices and hearings are readily accessible.

No disproportionately high or adverse human health or environmental effects on minority or low-income communities were identified. Mailing notices and distribution of other project information includes property owners and potentially affected persons and institutions without any distinction based on minority or income status. The local community was invited to all public meetings and their representatives attended plan formulation meetings to ensure input into the planning process. A public meeting was held during the public review period for the draft report to allow all interested parties an opportunity to learn about and comment on the RP. Socioeconomics and environmental justice Compliance are also discussed in Chapter 5. All public comments were received and addressed, as appropriate. The Project is in full compliance with EO 12898.

7.1.7 EO 13045, PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS

EO 13045, signed April 21, 1997, directs Federal agencies, to the extent permitted by law and as appropriate, to make identifying and assessing environmental health and safety risks that may disproportionately affect children a high priority and to ensure that policies, programs, activities and standards address disproportionate risks to children that result from environmental health or safety risks. Construction projects such as the RP include factors that could place children at increased health and safety risk due to the temporary generation of air pollutants, use of toxic materials like petroleum and diesel, increased truck traffic on surface streets and reduced access to some parks and open space where people, including children, may walk or ride bicycles. Implementing best management practices, including close coordination with local communities and their leaders, would reduce these risks. The RP is a FRM project designed to reduce the risk of flooding in the highly urbanized Stockton area. Individual decision-making during disasters is novel and dynamic because of the complexities and uncertainties inherent disasters, and children are particularly vulnerable. Children may have limited access to evacuation options and limited physical ability to respond to or withstand the rigors of such an emergency. The RP would reduce this risk.

7.1.8 EO 13112, INVASIVE SPECIES

EO 13112, signed February 3, 1999, directs all Federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. It established the National Invasive Species Council, composed of Federal agencies and departments, and the supporting Invasive Species Advisory Committee, composed of State, local and private entities. The Council's National Invasive Species Management Plan recommends objectives and measures to implement EO 13112, and to prevent the introduction and spread of invasive species (National Invasive Species Council 2008). EO 13112 requires consideration of invasive species in NEPA analyses, including their identification and distribution, their potential effects and measures to prevent or eradicate them.

7.1.9 FARMLAND PROTECTION POLICY ACT (7 U.S.C. 4201, *ET SEQ.*)

The FPPA was authorized to minimize the unnecessary and irreversible conversion of farmland to nonagricultural use due to Federal projects. It protects Prime and Unique Farmland, and land of State-wide or local importance. The FPPA protects forestland, pastureland, cropland or other land that is not water or urban developed land. The FPPA, administered by the NRCS, requires a Federal agency to consider the effects of its action and programs on the nation's farmlands. The NRCS is authorized to review Federal projects, and if farmland is being affected, determine a farmland conversion impact rating. USACE is required to provide the NRCS with project maps and descriptions to assist in determining impacts to prime farmland, unique farmland, and land of State-wide or local importance.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed and other agricultural crops with minimum inputs of fuel, fertilizer,

pesticides and labor, and without intolerable soil erosion. Unique farmland is land that is used for the production of specific high-value food and fiber crops such as citrus, tree nuts, olives, cranberries, fruits and vegetables. Farmland of State-wide or local importance is identified by State or local agencies for agricultural use, but not is not of national significance.

In California, NRCS uses a Land Evaluation and Site Assessment (LESA) system to establish a farmland conversion impact rating score on proposed sites of Federally-funded and assisted projects. The score is used as an indicator for the project sponsor to consider alternative sites if the potential adverse impacts on farmland exceed the recommended allowable level. Farmlands are scored on a scale of 260 points, and under the FPPA, those with a total score of less than 160 points need not be given further consideration for protection and no alternative sites need to be evaluated (FPPA Rule 401.24, Section 658.4).

USACE submitted the project's Farmland Conversion Impact Rating Form (NRCS-CPA-106) to NRCS in December 2015 with a finding of approximately 100 acres in the project area corridor and 28 acres to be converted from the total. In January 2016, NRCS returned the evaluated form to USACE with a rating of 82 out of 100. NRCS determined there to be a total of 14 acres of prime and unique farmland in the project area, with 0.003% of farmland to be converted. Additionally, NRCS confirmed that there are no NRCS conservation easements on lands included in the RP. The final Farmland Conversion Impact Rating form presents the total corridor assessment points to be 18 out of 160. Overall, the score from evaluations performed by both USACE and NRCS (total corridor assessment and relative value of farmland) was 100/260. It is unnecessary to conduct further consultation due to the score being well below the 160 point threshold.

Preliminary review indicates that the permanent impacts on prime farmlands resulting from construction of the RP would be considered less-than-significant since construction would primarily occur within the footprint of existing FRM infrastructure. New areas affected would mainly be within lands already converted to urban uses. Because the Farmland Impact Rating was received and evaluated by NRCS, the project is in full compliance with this Act. The LESA is established through the Farmland Conversion Impact Rating Form, which is included in the final report.

7.1.10 FISH AND WILDLIFE COORDINATION ACT OF 1958, AS AMENDED (16 U.S.C. 661, *ET SEQ.*)

The FWCA of 1958 requires that all Federal agencies consult with USFWS, NMFS and the affected State wildlife agency for activities that affect, control or modify surface waters, including wetlands and other waters. Under the FWCA, the USFWS, NMFS and CDFW have an extended responsibility for project review that encompasses concerns about plant and wildlife species that may not be addressed under NEPA and the Federal ESA. This extended responsibility may include a project's secondary effects on jurisdictional waters, including wetlands. USFWS and NMFS review CWA Section 404 permit applications as well as other Federal actions perceived to modify waters, and prepare a CAR to document the coordination between the Federal agency and the appropriate State regulatory agencies (Cylinder et al. 2004). The USFWS and CDFW participated in evaluating the proposed project, and the CAR is included in the Environmental Addendum. USACE is in full compliance with this Act because USFWS issued the final CAR, USACE has given full consideration to the USFWS' recommendations (see Section 6.2.1), and has included the CAR with the study report to Congress for project authorization.

7.1.11 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (16. U.S.C. 1801, *ET SEQ.*)

This Act establishes a management system for national marine and estuarine fishery resources. Essential Fish Habitat (EFH) is defined as "waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." It states that migratory routes to and from anadromous fish spawning grounds should

also be considered EFH. The phrase "adversely affect" refers to any effects that reduce the quality or quantity of EFH. Federal activities that occur outside an EFH, but that may have an effect on EFH waters and substrate, must also be considered in the consultation process. Effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

This Act requires Federal agencies to consult with NMFS regarding all actions or proposed actions permitted, funded or undertaken that may adversely affect EFH. In consulting, the action agency must provide a written assessment of the effects of their action on EFH to NMFS. If NMFS determines that a proposed Federal or State activity would adversely affect EFH, then NMFS is obligated to provide EFH conservation recommendations to the action agency. The action agency must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed for avoiding, mitigating or offsetting the impact of the activity on EFH. If the response is inconsistent with NMFS EFH conservation recommendations, the agency must explain its reasons for not following the recommendations.

The Delta Estuary and the SJR and its tributaries are designated EFH for Pacific salmon. Simultaneous with ESA Section 7 consultation, USACE consulted with NMFS under the MSA. The EFH consultation concluded that the RP would adversely affect the EFH of Pacific salmon in the action area. The EFH consultation adopts the ESA reasonable and prudent measures and associated terms and conditions from the BO and includes additional conservation recommendations specific to the adverse effects on Pacific salmon EFH in the action area as described in Amendment 18 of the Pacific Coast Salmon Plan. After USACE considers and responds to the conservation recommendations, the Project will be in compliance with this Act.

7.1.12 MIGRATORY BIRD TREATY ACT OF 1918, AS AMENDED (16 U.S.C. 703, *ET SEQ.*)

This Act, as amended, implements treaties and conventions between the United States, Canada, Japan, Mexico and Russia providing protection for migratory birds as defined in 16 U.S.C. 715j. It establishes hunting seasons and capture limits for game species and protects migratory birds, their occupied nests, and their eggs (16 USC 703, 50 CFR 21, 50 CFR 10). Permits from USFWS are required for both incidental and direct take.

Migratory birds and their nests are likely to occur within, and adjacent to, the footprint of proposed construction. The project is in a very urbanized area where traffic congestion and human activities are very common. Birds have adjusted to the human environment and continue to nest in these areas. To ensure that the project does not affect migratory birds, preconstruction surveys would be conducted by a qualified biologist in areas within and adjacent to the project construction site. If breeding birds are found in the area, a protective buffer would be delineated and USFWS and CDFG would be consulted for further actions. With the implementation of these surveys and subsequent avoidance of nesting birds, the Project would be in compliance with this Act.

7.1.13 NATIONAL ENVIRONMENTAL POLICY ACT (42 U.S.C. § 4321 *ET SEQ.*; 40 CFR 1500.1)

NEPA applies to all Federal agencies and most of the activities they manage, regulate or fund that affect the environment. NEPA requires every Federal agency to disclose the environmental effects of its actions for public review purposes and assists the Federal agency to assess alternatives to, and the consequences of, the proposed action. NEPA requires that an environmental document be prepared that considers, discloses and discusses all major points of view on the environmental impacts of the RP and Alternatives.

This document provides the information required by NEPA to consider the environmental consequences of the No Action and Action Alternatives. USACE is the lead Federal agency under NEPA for this project. The findings of this FR/EIS/EIR indicate that the RP, Alternative 7a, would have significant short- and

long-term impacts on the human environment. Implementation of mitigation measures, including BMPs, would reduce most impacts to less than significant levels. However, for some resources (vegetation, wildlife and fisheries), mitigation would not reduce short- and long-term impacts below significance.

The Draft FR/EIS/EIR was circulated for a 45-day public review. After the public review period, a final report was prepared that incorporates public comments, as appropriate. Following circulation of the Final FR/EIS/EIR for a 30-day public review and the execution of a ROD, the project will be in full compliance with NEPA.

7.1.14 NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED (16 U.S.C. 470)

NHPA Section 106 requires Federal agencies to consider the effects of a proposed undertaking on properties determined to be eligible for, or included in, the National Register of Historic Places. Letters with a request to participate in and comment on the draft PA were sent to the SJAFCA, DWR and SHPO on December 16, 2013. Copies of the draft PA were also sent to Native American Tribes with interest in the project area on November 23, 2013. Comments were received from DWR, SJAFCA and SHPO. No comments concerning the PA were received from the Tribes. Any proposed changes to the RP that require additional environmental effects analysis would also require additional consultation under Section 106 of this Act.

The PA was signed by USACE and the SHPO in May 2016, and is provided in the Environmental Addendum. The PA identifies specific stipulations that take into account the effects of the proposed project on cultural and historic properties. In addition to other specific requirements of the PA, additional records and literature searches would be conducted prior to conducting archaeological surveys of the APE. Consultation with Native American groups and individuals to identify properties of cultural significance would be maintained, and complete field surveys would be conducted prior to any construction. If historic properties are identified, USACE would evaluate effects to such properties. In consultation with SHPO, Native American Tribes, and any other interested stakeholders, USACE would produce a Memorandum of Agreement outlining a process to resolve adverse effects to any historic properties impacted by the Project.

7.1.15 NOISE CONTROL ACT OF 1972, AS AMENDED (42 U.S.C. 4901 *ET SEQ.*)

Inadequately controlled noise presents a growing danger to the health and welfare of the Nation's population, particularly in urban areas. The major sources of noise include transportation vehicles and equipment, machinery, appliances and other products in commerce. The Noise Control Act of 1972 establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. The Act also serves to: (1) establish a means for effective coordination of Federal research and activities in noise control; (2) authorize the establishment of Federal noise emission standards for products distributed in commerce; and (3) provide information to the public respecting the noise emission and noise reduction characteristics of such products.

While primary responsibility for control of noise rests with State and local governments, Federal action is essential to deal with major noise sources in commerce, control of which require national uniformity of treatment. EPA is directed by Congress to coordinate the programs of all Federal agencies relating to noise research and control. Also, the Act requires that Federal agency activities comply with all Federal, State, and local laws and regulations that regulate noise levels. The general plans for San Joaquin County, the City of Stockton and the City of Manteca identify noise emissions thresholds, which were incorporated into the significance thresholds used in the assessment of potential project impacts. Construction related noise is not likely to exceed land use compatibility thresholds on agricultural lands, but could result in intermittent noise impacts to residential uses within 700 feet of construction activities. Truck routes and detours would consider potential impacts to adjacent properties. All construction equipment would be properly maintained. No night-time construction is planned. The proposed levee improvements, flood wall and

closure structures would affect lands zoned for residential use, and additional mitigation such as the construction of temporary sound barriers or sound-proofing of homes could be required.

7.1.18 NOXIOUS WEED ACT OF 1974

The Noxious Weed Act (7 U.S.C. § 2801 *et seq.*) was authorized to control and manage the spread of nonnative plant species that may have adverse effects on agriculture, commerce wildlife resources, or public health. It inhibits the transport, trade or sales of noxious plant species in the U.S. and gave the Secretary of Agriculture authority to determine noxious plant species, and to establish measures to control them. As amended, the Act requires all Federal agencies to establish a management plan to control the spread of noxious plant species in their jurisdiction. A management plan would be developed and implemented for the construction phase of this project and included in the O&M Manual, after which the Project would be in compliance with this Act.

7.1.16 RESOURCE CONSERVATION AND RECOVERY ACT

This Act enables EPA to administer a regulatory project that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage and disposal of hazardous waste at all facilities and sites in the U.S. The LSJR Project would comply with this Act when transporting or disposing of hazardous material found in the project area.

7.1.17 UNIFORM RELOCATION ASSISTANCE AND REAL PROPERTY ACQUISITION POLICIES ACT OF 1970 (UNIFORM ACT), AS AMENDED (42 U.S.C. 4601 *ET SEQ.*)

This Act ensures the fair and equitable treatment of persons whose real property is acquired, or who are displaced as a result of a Federal or Federally-assisted project. All or portions of parcels within the LSJR Project footprint would need to be acquired for project construction. Federal, State, local government agencies and others receiving Federal financial assistance for public programs and projects that require the acquisition of real property must comply with the policies and provisions set forth in the Uniform Act, as amended in 1987, and implementing regulation 49 CFR Part 24. Relocation advisory services, moving costs reimbursement, replacement housing and reimbursement for related expenses and rights of appeal are provided for in the Uniform Act. Implementation of the LSJR Project would require acquisition of property in the footprint to construct FRM facilities and improvements. Also, temporary relocation of residents may occur during portions of construction. Property acquisition and relocation services, compensation for living expenses for temporarily relocated residents and negotiations regarding any compensation for temporary loss of business would be accomplished in accordance with the Uniform Act so this Project would be in compliance.

7.1.18 WILD AND SCENIC RIVERS ACT (16 U.S.C. 1271 *ET SEQ.*)

This Act establishes protection of rivers with important scenic, recreational, fish, wildlife and other values. Rivers are classified as wild, scenic or recreational. The Act designates specific rivers for inclusion and prescribes the methods and standards by which additional rivers may be added. The LSJR is not included in the system. So, the Project would have no effect on Wild or Scenic Rivers.

7.1.19 NATURAL RESOURCE CONSERVATION SERVICE CONSERVATION EASEMENTS

NRCS administers a range of conservation programs, including easements. NRCS-administered conservation easement programs include the Grassland Reserve Program, Wetlands Reserve Program and Farm and Ranchland Conservation Program. USACE coordinated with NRCS to confirm that no lands within the RP are currently under any NRCS conservation easements (Van Steyn, pers. com. 2015).

7.2 STATE REQUIREMENTS

7.2.1 ALQUIST-PRIOLO EARTHQUAKE FAULT ZONING ACT OF 1972 (PRC SECTION 2621 *ET SEQ.)*

Was enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994. It seeks to reduce the risk to life and property from surface fault rupture during earthquakes. It prohibits the location of most types of structures intended for human occupancy across the traces of active faults, and strictly regulates construction in the corridors along active faults (earthquake fault zones). It also defines criteria for identifying active faults, gives legal weight to terms such as *active*, and establishes a process for reviewing building proposals in and adjacent to earthquake fault zones. Under the Act, faults are zoned and considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during the Holocene Epoch (considered present time and defined for purposes of the Act as approximately the last 11,000 years). A fault is considered well defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface using standard professional techniques, criteria and judgment (Hart and Bryant 1997). The LSJR Project would not be constructed along or across any faults, and is in full compliance with this Act.

7.2.2 CALIFORNIA CLEAN AIR ACT

The CAA was signed into law in 1988 and, for the first time, clearly spelled out in statute California's air quality goals, planning mechanisms, regulatory strategies and standards of progress. It provides the State with a comprehensive framework for air quality planning regulations. Prior to passage of the Act, Federal law contained the only comprehensive planning framework.

The CAA requires attainment of State ambient air quality standards by the earliest practicable date. For air districts in violation of the State ozone, carbon monoxide, sulfur dioxide or nitrogen dioxide standards, attainment plans were required by July 1991. CARB is responsible for the development, implementation and enforcement of California's motor vehicle pollution control program, GHG State-wide emission estimates and goals and development and enforcement of GHG emission reduction rules. A summary of the major California GHG regulations that will affect the project's GHG emissions requires projects to determine whether emission sources and levels significantly affect air quality based on Federal standards established by USEPA, and State standards set by CARB. Compliance with the CAA for GHG emissions is expected with incorporated mitigation specified in Chapter 5. As a result, full compliance with this Act is expected with coordination with SJVAPCD and preconstruction permitting.

7.2.3 CALIFORNIA ENDANGERED SPECIES ACT

The ESA was enacted in 1984 and prohibits the take of listed endangered, threatened and candidate species. It defines take as an activity that would directly or indirectly kill an individual of a species; habitat destruction is not included in the State's definition of take. This Act requires the NFS to consider the potential adverse effects to State-listed species. As a joint NEPA/CEQA document, this FR/EIS/EIR considered the potential effects to State listed species, as discussed in Chapter 5. CDFW administers the Act and authorizes take through Section 2081 agreements (except for species designated as fully protected). CDFW can adopt a Federal biological opinion as a State biological opinion under California Fish and Game Code, Section 2095. In addition, CDFW can write a consistency determination for species that are both Federal and State listed if CDFW determines that the avoidance, minimization and compensation measures will ensure no take of species.

San Joaquin County, including the project area, is covered by the San Joaquin County Multispecies Conservation and Open Space Plan, approved in 2000. It covers an expansive list of species and habitats of interest at Federal, State and local levels. Species that are under the jurisdiction of the NMFS are not

comprehensively covered. This conservation plan was considered during development of project alternatives and identification of the RP. The Project is consistent with the conservation plan.

There is the potential for the LSJR Project to impact the State-listed GGS, and Swainson's hawk if nests are present at the construction sites. The State coordinated with CDFW regarding potential impacts to State-listed species. Since the GGS is both Federal and State listed, USACE consulted with USFWS under Section 7 and the RP incorporates conservation measures that would be implemented at construction sites where there is GGS habitat. Prior to construction of any site, USACE and the State would conduct Swainson's hawk surveys to determine the presence of nests. If nests are present, coordination with CDFW would occur to determine any mitigation or minimization measures that would need to be implemented to protect Swainson's hawks. The LSJR Project would be in full compliance with this Act once these surveys are conducted, coordination has occurred.

7.2.4 CALIFORNIA ENVIRONMENTAL QUALITY ACT

CEQA applies to an action that is directly undertaken by a California public agency; is supported in whole or part by California public agency contracts, grants, subsidies, loans or other assistance for a public agency; or involves the issuance by a California public agency of a permit, lease, license, certificate or other entitlement for use by a public agency. CEQA requires State, regional and local agencies to prepare environmental documents assessing the significant environmental impacts of the RP, to circulate these documents to other agencies and the public for comment, and to consider these comments in their decision-making.

The CEQA lead agency for this project is SJAFCA. This FR/EIS/EIR was prepared jointly with the NEPA and CEQA Lead Agencies to meet both requirements. SJAFCA and CVFPB evaluated this project under CEQA guidelines and determined that the mitigation measures incorporated would reduce most impacts to less than significant levels; however, impacts to some resources (vegetation, wildlife, fisheries) would remain significant. Therefore, a Statement of Overriding Considerations would be prepared.

Upon certifying the document, CEQA lead agencies would adopt a reporting or monitoring program for the changes made to the project or the conditions of project approval to mitigate or avoid significant environmental effects. Full compliance would be achieved when the Final FR/EIS/EIR and Notice of Determination (Statement of Overriding Consideration) is sent to the Office of Planning and Research.

7.2.5 CALIFORNIA FISH AND GAME CODE

CDFW provides protection from take for various species under the CFGC. CDFW also regulates work that will substantially affect resources associated with rivers, streams and lakes in California, pursuant to CFGC Sections 1600 to 1607. Section 1602 requires project proponents to notify CDFW before any project that would divert, obstruct or change the natural flow, bed, channel or bank of any river, stream or lake. CDFW's jurisdiction extends to the top of banks and often to the outer edge of riparian vegetation canopy cover. Riparian trees with a diameter of 6 inches or greater also fall within CDFW's jurisdiction. Preliminary notification and project review generally occur during the environmental process. When an existing fish or wildlife resource may be substantially adversely affected, CDFW is required to propose reasonable changes to the project to protect the resources that are formalized in a streambed alteration agreement that becomes part of the plans, specifications and bid documents. An application for a Streambed Alteration Agreement would be submitted to CDFW to authorize the LSJR Project under Section 1602 and provide full compliance.

7.2.6 CALIFORNIA FOOD AND AGRICULTURE CODE

The California Department of Food and Agriculture lists 171 plants as noxious weeds. A noxious weed is defined as any plant species that is, or is liable to be, troublesome, aggressive, intrusive, detrimental or destructive to agriculture, silviculture or important native species, and difficult to control or eradicate (California Food and Agricultural Code Section 5004). Any area that is infected with any pest, including noxious weeds, is considered a public nuisance. It is unlawful for any persons to maintain the nuisance. It should be abated (California Food and Agriculture Code Sections 5401-5403). Noxious weeds were identified for the project area. In order to control post-construction establishment of noxious weeds on disturbed soils, a noxious weed control plan would be incorporated into the construction plans. Noxious weeds would be controlled within the construction area until native plants are established and conditions are unfavorable for the establishment of noxious weeds.

7.2.7 CALIFORNIA GLOBAL WARMING SOLUTIONS ACT

California Assembly Bill 32, the California Global Warming Solutions Act of 2006, identifies California as a substantial source of GHG emissions and requires a significant emissions reduction. GHG emissions levels must be reduced to 2000 levels by 2010, to 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. The emissions reduction is expected to be achieved through the continuation of existing State policies, and through the enforcement of a State-wide GHG emissions limit incorporated in 2012.

Existing policies aimed at limiting GHG emissions include Assembly Bill 1493, which requires CARB to define standards for cars and light trucks manufactured after 2009, and is projected to result in an 18 percent reduction in emissions. In addition, SB 97, enacted in 2007, requires that CEQA guidelines be amended to incorporate analysis and mitigation of GHG emissions in CEQA documents. The Natural Resources Agency adopted the CEQA Guideline Amendments on December 30, 2009, under §15064.4.

The action alternatives would result in a temporary increase in GHG emissions as a result of project-related construction. These impacts would be reduced to less than significant through mitigation. Additional analysis of staging area location, truck routes and detours would be conducted during the PED phase to minimize potential impacts on local traffic. The Project could result in minor traffic delays during construction, but would not permanently increase travel times through the affected areas. FRM would primarily be extended to currently developed areas and future development, beyond urban in-fill, would not induce or otherwise result in a long-term, indirect increase in vehicle-related GHG emissions.

7.2.8 CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC)

The CPUC regulates privately owned telecommunications, electric, natural gas, water, railroad, rail transit and passenger transportation companies. CPUC is responsible for ensuring that California utility customers have safe, reliable utility service at reasonable rates, protects utility customers from fraud and promotes the health of California's economy. CPUC establishes service standards and safety rules, and authorizes utility rate changes. CPUC also enforces CEQA compliance for utility construction and regulates the relocation of power lines by public utilities under its jurisdiction. CPUC works with other State and Federal agencies in promoting water quality, environmental protection and safety. The LSJR Project is in full compliance with CPUC standards and rules when relocating public utilities.

7.2.9 CALIFORNIA SEISMIC HAZARDS MAPPING ACT

The California Seismic Hazards Mapping Act of 1990 (California PRC Sections 2690–2699.6) addresses seismic hazards other than surface rupture, such as liquefaction and induced landslides. It specifies that the lead agency for a project may withhold development permits until geologic or soils investigations are conducted for specific sites and mitigation measures are incorporated into plans to reduce hazards

associated with seismicity and unstable soils. As described in Chapter 5, there are no active faults in the LSJR Project area. In the North Stockton area, the RP includes construction of seismic remediation on and along levees to increase the seismic resilience of the levees. As a result, there would be no significant effects on the project due to seismicity. The Project is in full compliance with this Act.

7.2.10 CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION (CDPR)

In an effort to address pesticide-related impairments and their effects, the CDPR developed a water monitoring program. In 1991, SWRCB signed a Memorandum of Agreement with the CDPR to ensure that pesticides registered for use in California are used in a manner that protects water quality while recognizing the need for pest control. This agreement was revised in 1997 to facilitate implementation of the original agreement. The use of pesticides to control noxious weeds in the project area would be conducted according to product labels and coordinated through the 401 State Water Quality Certification and NPDES General Permit application process.

7.2.11 CALIFORNIA SURFACE MINING AND RECLAMATION ACT

The SMARA of 1975 (PRC Sections 2710–2719) is the principal legislation addressing mineral resources in California. Surface mining operations include, "...borrow pitting, streambed skimming, segregation and stockpiling of mined materials (and recovery of the same) ..." (CCR, Title 14, Section 3501). Section 3501 further defines excavations for onsite construction as "earth material moving activities that are required to prepare a site for construction of structures, landscaping, or other land improvements (such as excavation, grading, compaction, and the creation of fills and embankments), or that in and of themselves constitute engineered works (such as dams, road cuts, fills, and catchment basins)." SMARA was enacted in response to land use conflicts between urban growth and essential mineral production. Its purpose is to provide a comprehensive surface mining and reclamation policy to encourage the production and conservation of mineral resources, while ensuring that significant environmental effects of mining are prevented or minimized, mined lands are reclaimed, residual hazards to public health and safety are eliminated and consideration is given to recreation, watershed, wildlife, aesthetic and other related values.

Borrow activities associated with the LSJR Project would disturb more than 1 acre or remove more than 1,000 cubic yards of material through surface mining activities, including the excavation of borrow pits for soil material. Therefore, the project proponent(s) must comply with SMARA as it governs the use and conservation of a wide variety of mineral resources, although some resources and activities are exempt from its provisions, including excavation and grading conducted for farming, construction or recovery from flooding or other natural disasters. The State Mining and Geology Board reviews the local ordinances to ensure they meet the procedures established by SMARA. Cities and counties have authority to enforce SMARA and create additional regulations. San Joaquin County is the SMARA lead agency for surface mining operations in the project area. In general, SMARA permitting requires lead agency approval of a permit, reclamation plan and the posting of approved financial assurance for the reclamation of mined land. Compliance would be achieved by either obtaining a SMARA permit or exemption. SMARA permits or exemptions would be obtained, as appropriate, for selected borrow sites. Borrow would be obtained from willing sellers within a 25-mile radius of the project. Excavation activities would not commence until all regulatory and compliance requirements for borrow activities have been met.

7.2.12 CALIFORNIA WATER CODE

The LSJR Feasibility Study is located within the Central Valley RWQCB's jurisdiction, within the greater San Joaquin Valley Watershed. The preparation and adoption of water quality control plans, or Basin Plans, and State-wide plans, is the responsibility of the SWRCB. State law requires that Basin Plans conform to policies set forth in the California Water Code beginning with Section 13000 and any State policy for water

quality control. These plans are required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards that "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected and water quality objectives to protect those uses. Adherence to Basin Plan water quality objectives protects continued beneficial uses of water bodies. Because beneficial uses and corresponding water quality objectives can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting State and Federal requirements for water quality control (40 CFR 131.20). The potential effects of the proposed project on water quality were evaluated and are discussed in Chapter 5. Compliance with the California Water Code will be accomplished by obtaining certifications from the Central Valley RWQCB and an internal 404 review by USACE.

7.2.13 CALIFORNIA WILD AND SCENIC RIVERS ACT OF 1972

The purpose of this Act is to preserve and protect wild and scenic rivers and their immediate environments for the benefit of present and future generations. The legislature must approve any action that would affect a designated river. The primary difference between this Act and the Federal Act is that the Federal Energy Regulating Committee may issue a license to build a dam on a State-listed river, thus overriding the State statute. None of the waterways within the study area are designated as a California Wild and Scenic River (California Public Resources Code Section 5093.50 *et seq.*).

7.2.14 CENTRAL VALLEY FLOOD PROTECTION BOARD ENCROACHMENT PERMIT

Under California law, no reclamation project of any kind may be started or carried out on or near the Sacramento and San Joaquin Rivers or their tributaries until plans have first been approved by CVFPB. The CVFPB's efforts focus on controlling floodwater, reducing flood damage, protecting land from floodwater erosion that would affect project levees and controlling encroachment into floodplains and onto flood-control works, such as levees, channels and pumping plants. Proposed measures would result in beneficial impacts by reducing flood damage risk and would not promote indirect development within the floodplain or onto flood control works.

Banks, levees and channels of floodways along any stream, its tributaries or distributaries may not be excavated, cut, filled, obstructed or left to remain excavated during the flood season, which is November 1 through July 15 for the San Joaquin River. The CVFPB, at prior written request of USACE, may allow work to be done during the flood season within the floodway, provided that, in the judgment of the CVFPB, forecasts for weather and river conditions are favorable.

Levees constructed, reconstructed, raised, enlarged or modified within a floodway shall be designed and constructed in accordance with the USACE manual, "Design and Construction of Levees" (EM 1110-2-1913). Evaluation of levee embankment and foundation stability and a detailed settlement analysis must be conducted to ensure long-term stability during full flood stage. Additional standards for levee construction, including easement conditions, are provided in Title 23, Code of California Regulations, Division 1, Article 8, Section 120, Levees.

The CVFPB is a NFS of this Study; therefore, an encroachment permit would not be sought.

7.2.15 EO S-3-05

Signed by Governor Arnold Schwarzenegger on June 1, 2005, this Order asserts that California is vulnerable to the effects of climate change. It puts forth that increased temperatures could reduce the Sierra Nevada snowpack, further exacerbate California's air quality problems and potentially cause a rise in sea

levels. To combat those concerns, the EO established total GHG emissions targets. It also established the following GHG emissions reduction targets:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80% below 1990 levels.

The EO directed the Secretary of the California Environmental Protection Agency to initiate a multi-agency effort to reduce GHG emissions to target levels. To comply, the Secretary created a Climate Act Team composed of members of various State agencies and commissions. The Climate Act Team released its first report in March 2006 (California EPA 2006). The report proposes achieving GHG targets through voluntary actions of California businesses, local government and community actions, and State incentive and regulatory projects. The LSJR Project would fully comply with this EO.

7.2.16 HAZARDOUS WASTE CONTROL ACT

The Act created the State Hazardous Waste Management Project, which is similar to but more stringent than the Federal Resource Conservation and Recovery Act Project. The Act is implemented by regulations contained in Title 26 CCR, which describes the following elements required for the proper management of hazardous waste:

- Identification and classification;
- Generation and transportation;
- Design and permitting of recycling, treatment, storage, and disposal facilities;
- Treatment standards;
- Operation of facilities and staff training; and
- Closure of facilities and liability requirements.

These regulations list more than 800 materials that may be hazardous and establish criteria for identifying, packaging and disposing of such waste. Under the Hazardous Waste Control Act and Title 26, the generator of hazardous waste must complete a manifest that accompanies the waste from generator to transporter to the ultimate disposal location. Copies of the manifest must be filed with the California Department of Toxic Substances and Control. The LSJR Project would properly manage the identification, transport and disposal of hazardous wastes during construction, and therefore, be in full compliance with this Act.

7.2.17 PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act of 1970 established the SWRCB and nine RWQCBs within California. These groups are the primary State agencies responsible for protecting California water quality to meet present and future beneficial uses, and regulating appropriative surface rights allocations. The preparation and adoption of water quality control plans, or Basin Plans, and State-wide plans, is the responsibility of the SWRCB. State law requires that Basin Plans conform to the policies set forth in the California Water Code beginning with Section 13000 and any State policy for water quality control. These plans are required by the California Water Code (Section 13240) and supported by the Federal CWA. Section 303 of the CWA requires states to adopt water quality standards which "consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, and water quality objectives to protect those uses. Adherence to Basin Plan water quality objectives protects continued

beneficial uses of water bodies. The potential effects of the RP on water quality were evaluated and are discussed in Chapter 5.

In 1992, the State WQCB adopted a general NPDES permit (Order No. 92-08-DWQ, General Permit No. CAS000002) that applies to construction projects resulting in land disturbance of 5 acres or greater. In order to obtain a State-wide NPDES general construction permit, an action must comply with CVRWQCB's Water Quality Control Plan for the Sacramento and San Joaquin River Basins, the Central Valley Pesticide TMDL and Basin Plan Amendment, San Joaquin River Organophosphorus Pesticide TMDL, San Joaquin River Dissolved Oxygen TMDL, and the San Joaquin River Upstream Salinity and Boron TMDL. Prior to construction, USACE would obtain a NPDES general construction permit. Conditions of the permit would require development and implementation of a storm water pollution prevention plan to limit effluent discharge as a result of storm water runoff and performance of inspections of storm water pollution prevention measures during and after construction.

The Project expects to achieve full compliance with the Act by achieving compliance with RWQCB certification mandates for Section 401 of the Federal CWA.

7.2.18 RELOCATION ASSISTANCE AND PROPERTY ACQUISITION

The State of California's Government Code Section 7260, *et seq.* brings the California Relocation Act into conformity with the Federal Uniform Act. In the acquisition of real property by a public agency, both the Federal and State Acts seek to: (1) ensure consistent and fair treatment of owners of real property, (2) encourage and expedite acquisition by agreement to avoid litigation and relieve congestion in the courts, and (3) promote confidence in public land acquisition. The Relocation Assistance and Real Property Acquisition Guidelines were established by 25 CCR 1.6. The guidelines were developed to assist public entities with developing regulations and procedures for implementing 42 USC 61—the Uniform Act, for Federal and Federally assisted projects. The guidelines are designed to ensure that uniform, fair and equitable treatment is given to people displaced from their homes, businesses or farms as a result of the actions of a public entity. Under the Uniform Act, persons required to relocate temporarily are not considered "displaced," but must be reimbursed for all reasonable out-of-pocket expenses. In accordance with these guidelines, people will not suffer disproportionate injury as a result of action taken for the benefit of the public as a whole. Additionally, public entities must ensure consistent and fair treatment of owners of such property, and encourage and expedite acquisitions by agreement with owners of displaced property to avoid litigation. Property acquisition and relocation services, compensation for living expenses for temporarily relocated residents and negotiations regarding any compensation for temporary loss of business would be accomplished in accordance with the Uniform Act (see discussion above) and California Government Code Section 7267, *et seq* for the LSJR Project, providing full compliance.

7.2.19 TITLE 24 OF THE CALIFORNIA CODE OF REGULATIONS: CALIFORNIA BUILDING CODE

The California Building Standards Commission (BSC) is an independent commission within the State and Consumer Services Agency that codifies and publishes approved building standards in one State building standards code (California Code of Regulations, Title 24). The California BSC provides guidance to architects, engineers, insurance companies, etc., when making decisions about the building industry. The BSC ensures that the California building codes effectively address areas such as health, fire and panic safety, employee safety, energy conservation and handicapped accessibility. The BSC determines if such codes and standards are in the public interest. Construction standards for levees are found within the California Code of Regulations. Additional analysis and design would be required during the PED phase.

7.2.20 WILLIAMSON ACT AND FARMLAND SECURITY ZONE ACT

The California Land Conservation Act of 1965, commonly referred to as the Williamson Act, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. In return, landowners receive property tax assessments that are much lower than normal, because they are based on farming and open space uses as opposed to full market value. Local governments receive an annual subvention of forgone property tax revenues from the State via the Open Space Subvention Act of 1971.

The Williamson Act was amended in August 1998 to establish Farmland Security Zones. Under this Farm Bureau–sponsored Super Williamson Act, landowners can receive an additional 35 percent reduction in the land's value for property tax purposes. This additional tax reduction can be earned only if farmers and ranchers keep their property in the conservation project for at least 20 years. Farmland Security Zone contracts are comparable to the Williamson Act contracts in that each year, another year is added to the agreement unless the landowner or county does not renew the contract. The legislation prohibits the annexation of land enrolled in a 20-year contract to a city, or a special district that provides nonagricultural services, or for use as a public school site.

Of California's 58 counties, 52 adopted the Williamson Act Project. San Joaquin County is included in those that adopted the act. The location of these lands in the project vicinity is discussed in Chapter 5. The LSJR Project would not take any lands that are covered under the Williamson Act, and would, therefore, be in full compliance.

7.3 LOCAL PLANS AND POLICIES

7.3.1 AIR POLLUTION CONTROL DISTRICTS

California has 35 local air pollution control districts throughout the State. Each district is responsible for establishing and enforcing air pollution regulations in order to attain and maintain all Federal and State ambient air quality standards. These districts permit stationary sources of air pollution and implement transportation control measures for their respective regions. In order to combat particular air quality problems within its region, each district adopts its own rules and regulations as the types of sources of air emissions vary from district to district. San Joaquin County is within the San Joaquin Valley Air Pollution Control District (SJVAPCD). The SJVAPCD made up of eight counties in California's Central Valley: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and the valley portion of Kern. Federal and State laws require emission control measures in areas where air pollution exceeds standards; the San Joaquin Valley is one of these areas. The SJVAPCD developed air pollution control measures under three CARB-approved Air Quality Plans: the Extreme Ozone Attainment Demonstration Plan, Carbon Monoxide Maintenance Plan, and a PM_{10} Maintenance Plan. The RP would comply with all control measures to mitigate impacts to air quality to less than significant, including minimization of the construction footprint, wetting of soils and proper maintenance of construction equipment.

7.3.2 PUBLIC WORKS AND TRANSPORTATION DEPARTMENTS

An encroachment permit must be obtained when encroachments are proposed within, under or over a county or city road, or cover rights-of-way. The NFS would consult the appropriate local agencies to obtain the encroachment permits once the project is authorized. Conditions of the encroachment permit would include measures to ensure public safety and the acceptable flow of traffic.

7.3.3 MOSQUITO ABATEMENT DISTRICT

The San Joaquin County Mosquito and Vector Control District is responsible for conducting mosquito abatement and vector control in San Joaquin County. In addition, San Joaquin County maintains a Mosquito Surveillance Task Force. Both of these organizations serve under the County Board of Supervisors. SJAFCA is the local sponsor and would coordinate with the County to determine if any additional mosquito abatement is required by the RP. The only area identified as potentially of concern is the Smith Canal, where water exchange between the Canal and the San Joaquin River/Stockton DWSC would be reduced.

7.3.4 LOCAL GENERAL PLANS

Section 65300 of the California Government Code states that "Each planning agency shall prepare, and the legislative body of each county and city shall adopt, a comprehensive, long term general plan for the physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning." The general plan is to consist of seven mandatory elements, and as many optional elements as the local jurisdiction deems desirable. The mandatory elements include land use, circulation, housing, open space, conservation, safety and noise. The San Joaquin County, Stockton, Lathrop and Manteca General Plans were consulted and considered during development and evaluation of the Alternatives and the RP. Where applicable, the policies and regulations established by the General Plans were incorporated into significance thresholds. The RP, including proposed mitigation measures, would comply with or enhance the achievement of most of the policies and regulations established by the General Plans. Some conflict exists between local policies regarding preservation of native vegetation and wildlife and the RP's potential impact on these resources.

CHAPTER 8 — RECOMMENDED PLAN

This chapter describes the RP, as well as the procedures and cost sharing required for implementation if it is authorized and appropriated by Congress. A schedule and list of further studies are also included.

8.1 RECOMMENDED PLAN

The RP is Alternative 7a (Figure 8-1). This plan has a benefit to cost ratio of 7.0 to 1.0 and provides net annual FRM benefits of $295,730,000. This plan would allow the local community to continue to meet both FEMA certification requirements and at least a portion of the State of California's criteria for funding of FRM projects, allowing for potential reduction in National Flood Insurance Program costs to the community and leveraging State bond funds for project implementation. Documentation of compliance with FEMA and State criteria are the responsibility of the NFS. The RP greatly reduces flood risk to people and property in the city of Stockton. The RP provides benefits to 162,000 residents by improving Federal and local levees that provide FRM. The RP also offers the area an estimated 83 percent reduction in expected annual property damage, while enhancing security at 486 critical infrastructure sites – 23 of which are essential to life-safety. There is residual risk of flooding from the Stockton Diverting Canal and Calaveras River levees that will not be improved by the RP. The RP is described briefly below, including the specific cost share requirements associated with approved policy. For more information, see Chapter 3 and the appendices (Appendix A: Economics , Appendix B: Engineering, and Appendix C: Real Estate) and supporting documentation.

8.1.1 FEATURES AND ACCOMPLISHMENTS

The RP is shown in Figure 8-1. Features are listed below and additional detail may be found in the Appendix B: Engineering.

Delta Front

- 3.05 miles of fix in place improvements with soil-bentonite cutoff walls of various depths with 2.5 miles of geometry improvement.
- 1.1 miles of seismic fixes through deep soil mixing in North Stockton along two segments of Tenmile Slough, including approximately 1,200 feet along the Stockton Deep Water Ship Channel.
- 1.33 miles of new setback levee along the Delta Front to eliminate the eastern portions of the Fourteenmile Slough levee in North Stockton.
- 0.59 miles of height improvements between 1.8 and 2.7 feet on the Delta Front.
- 5 miles of erosion protection.
- Closure Structure on Fourteenmile Slough.

North Stockton

- 9.4 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in North Stockton.
- 2.03 miles of height improvements between 1.4 and 1.6 feet in North Stockton.

Central Stockton

- 9.2 miles of fix in place improvements with soil-bentonite cutoff walls of various depths in Central Stockton.
- 2 miles of levee geometry improvements in Central Stockton along one segment of the Calaveras River and one segment of the San Joaquin River.
- 0.53 miles of height improvements of 1.8 feet in Central Stockton.
- 0.75 miles of new levee with soil-bentonite cutoff wall on Duck Creek to address flanking of flood waters from south of Central Stockton.
- 0.28 miles of height improvements of 4 feet on the RD 404 levee.
- Closure Structure at Smith Canal with 0.2 miles of floodwall.

The RP requires the non-Federal sponsors prepare a Floodplain Management Plan, including a FWEEP, as required for all USACE FRM projects per Sec 402 WRDA 86, as amended.

The RP also includes 5 miles of rock revetment for erosion protection to address wind and wave loading in North Stockton along Fourteenmile Slough, Fivemile Slough, Shima Tract, and Tenmile Slough. The RP includes establishment of USACE ETL 1110-2-583-compliant levees, as described in Chapter 4, and a commitment to evaluate the levees' suitability for a vegetation variance to the ETL. Figure 8-2 details existing levees in the RP and delineates their status prior to project implementation. There are 14.2 miles of existing Federal levee segments within the RP. A total of 9.5 miles of existing non-Federal levee and 0.75 miles of newly constructed levee will be added to the Federal levee system as part of the RP. The RP is compatible with other local efforts to meet ULOP requirements mandated by California SB 5. The RP is designed to include a level of levee superiority upstream of French Camp Slough, providing increased resiliency to floods in excess of design.

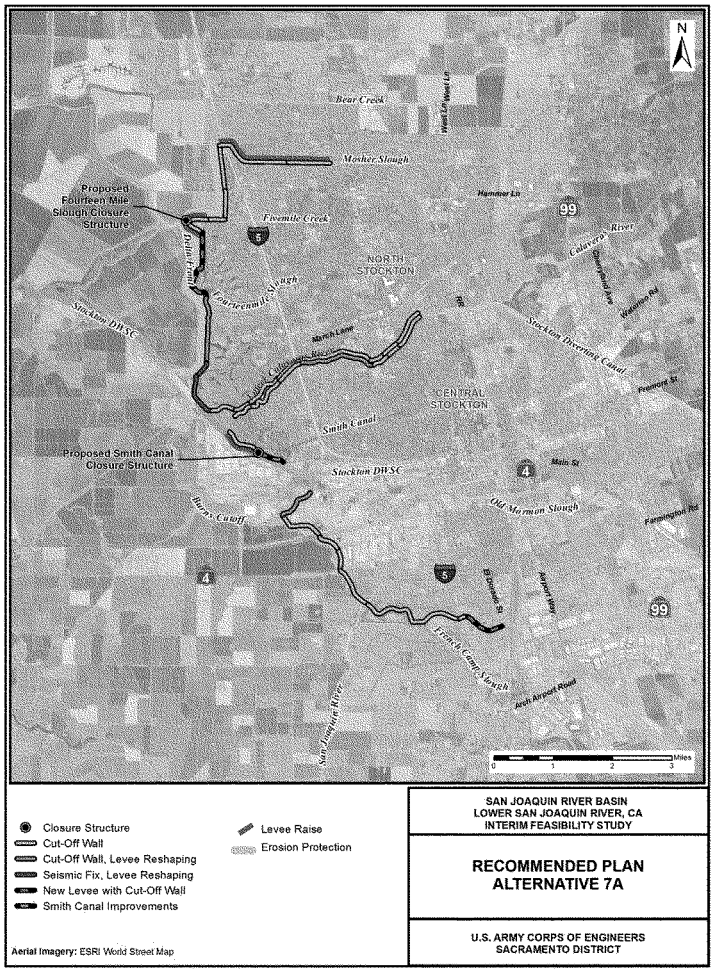


Figure 8-1: Recommended Plan and Design Feature

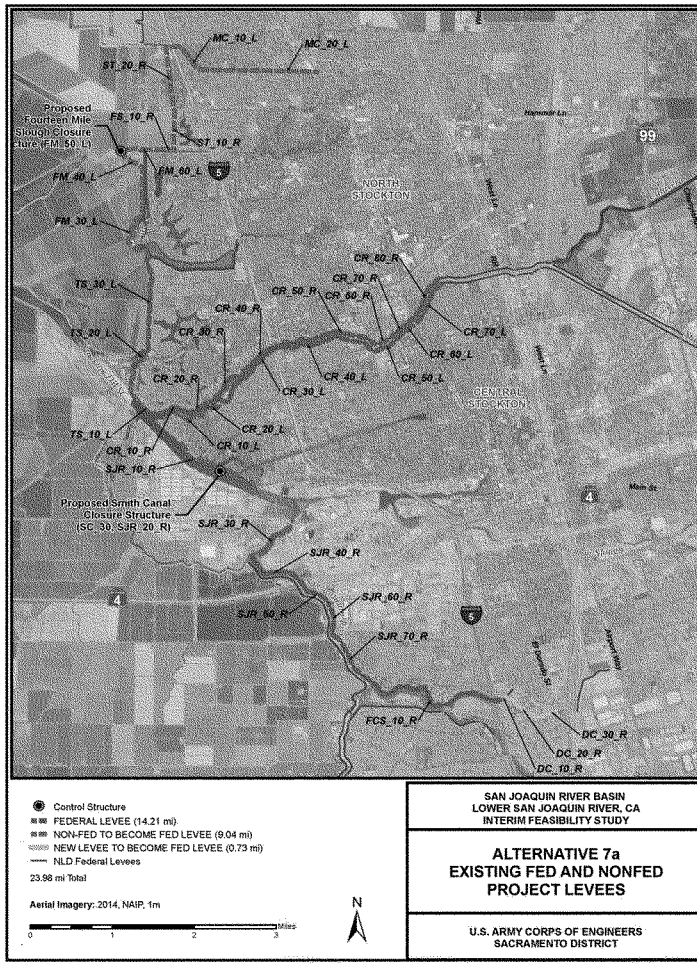


Figure 8-2: Existing Federal, non-Federal becoming Federal and New Levees

8.1.2 MITIGATION

Mitigation includes all measures that would avoid, minimize, offset or compensate for potential environmental effects. When considered under the Federal Endangered Species Act, these measures may be referred to as conservation measures. As required under NEPA, potential mitigation and conservation measures for each resource are described in Chapter 5. This section identifies those measures that are included in the RP. Mitigation assumes the levees will be determined to be suitable for a variance to USACE ETL 1110-2-583 that would allow 25% of the trees and shrubs on the lower levee slope and within the waterside easement to remain. During PED, Sacramento District will conduct appropriate engineering investigations to determine the suitability of RP levees for a variance.

The project would purchase credits at a local mitigation bank for permanent impacts to GGS uplands and aquatic habitat, riparian, SRA, Delta smelt shallow water, open water, and wetland habitats. The District has consulted with potential mitigation banks annually since 2013 to check on credit availability. The proposed project is within the service area of the USFWS/NMFS approved banks identified in Table 8-1.

Table 8-1: Mitigation Banks

Type of Credit	Mitigation Bank	Website	Service Area
GGS habitat	Grassland Mitigation Bank	http://www.wesmitigation.com/advance-conservation-project-in-san-joaquin-valley-will-boost-flood-and-giant-garter-snake-protection/	grasslands-ggs-service-area 2017.pdf
Riparian habitat	Cosumnes Floodplain Mitigation Bank	http://www.wesmitigation.com/cabanks/another-california-bank/	cosumnes-service-area 2017.pdf
SRA	Cosumnes Floodplain Mitigation Bank	http://www.wesmitigation.com/cabanks/another-california-bank/	
Delta smelt habitat	Liberty Island Conservation Bank North Delta Fish Conservation Bank	https://www.fws.gov/sfbaydelta/EndangeredSpecies/ConservationBanking/index.htm	liberty_isl_conservation_bank_service_ar North Delta Service Area 2017.pdf
Wetlands	Cosumnes Floodplain Mitigation Bank	http://www.wesmitigation.com/cabanks/another-california-bank/	

Environmental Commitments

Environmental commitments are relatively standardized and compulsory best practices that represent sound and proven methods to avoid or reduce potential effects. Although environmental commitments fall within

the NEPA definition of mitigation through avoidance and minimization, the costs for implementing these measures are accounted for within the PED or Construction accounts, as appropriate, and are not included in the fish and wildlife habitat mitigation account. These measures were discussed in Chapter 5. The environmental commitments identified in Table 8-2 would be implemented to avoid or reduce short-term, construction-related effects.

Table 8-2: Environmental Commitments

Environmental Commitment	Timing	Responsible Party
Nesting or roosting raptors survey	Prior to construction	USACE/SJAFCA in coordination with USFWS and CDFW
Nesting or roosting migratory birds survey	Prior to construction	USACE, in coordination with the construction contractor
Invasive plant species prevention	During and following construction	USACE, in coordination with the construction contractor
Invasive aquatic species prevention	During and following construction	USACE, in coordination with the construction contractor
Vegetation removal, particularly tree removal, would be conducted between September 16 and January 31, to the extent feasible, to minimize potential loss of active bird nests and bat maternity roosts.	During construction	USACE, in coordination with the construction contractor, USFWS, and CDFW.
Noise-reducing construction practices	During construction	USACE, in coordination with the construction contractor
Property acquisition compensation and temporary resident relocation plan	Prior to and during construction	SJAFCA
Traffic control and road maintenance plan	During construction	USACE, in coordination with its contractor and the city and county public works departments
Coordination to ensure minimal overlap in disturbances to traffic during construction	Prior to and during construction	USACE, in coordination with construction contractor
Construction area closure notification	Prior to construction	USACE, in coordination with construction contractor
Minimize construction-related effects on navigation	During construction	USACE, in coordination with construction contractor
Minimize effects associated with recreation	During construction	USACE, in coordination with construction contractor
Stormwater Pollution Prevention Plan	Prior to construction	USACE, in coordination with construction contractor
Bentonite Slurry Spill Contingency Plan (Frac-out Plan)	Prior to construction	USACE, in coordination with construction contractor
Spill Prevention, Control, and Countermeasure Plan	Prior to construction	USACE, in coordination with construction contractor
Turbidity Monitoring in Adjacent water bodies	During construction	USACE, in coordination with construction contractor
Groundwater Well Protection measures	During construction	USACE, in coordination with construction contractor
Soil Supply protection measures	Prior to, during, and following construction	USACE, in coordination with construction contractor
Soil hazards testing and soil disposal plan	Prior to construction	USACE, in coordination with construction contractor
HTRW Contingency Plan	Prior to construction	USACE, in coordination with construction contractor

Environmental Commitment	Timing	Responsible Party
In-water closure structure design and operation coordinated with the Regional Water Quality Control Board, USFWS, NMFS, and CDFW	During PED	USACE
Giant Garter Snake and its habitat effects minimization	Prior to and during construction	USACE
Field surveys would be conducted to identify and delineate jurisdictional wetlands that could be directly or indirectly affected by the RP.	Prior to construction	USACE
Install exclusion fencing along the perimeter of the construction work area and implement general measures to avoid effects on sensitive natural communities and special-status species	Prior to and during construction	USACE, in coordination with construction contractor
Conduct mandatory contractor/worker awareness training for construction personnel	Prior to and during construction	USACE, in coordination with construction contractor
Retain a biological monitor	During construction	USACE, in coordination with construction contractor
Seed or plant areas disturbed by construction with appropriate native species	After construction	USACE, in coordination with contractor

Conservation Measures for Avoidance, Minimization, and Compensation (ESA)

Measures to conserve Federally-listed species were developed with input from USFWS and NMFS during informal and formal Section 7 consultation. Avoidance and minimization measures that are part of the RP are identified in Chapter 5, Section 5.12.10. Some additional measures are specified in the terms and conditions included in the USFWS and NMFS biological opinions (see Environmental Addendum). Construction would be scheduled when listed terrestrial and aquatic species are least likely to occur in the project area, approximately May or June through October depending on the species present on a site-specific basis. If construction needs to extend into the timeframe that species are present, USACE would coordinate with the resource agencies. Compensatory conservation measures are part of the RP and are identified in Table 8-3. These measures are included in the Habitat Mitigation, Monitoring, and Adaptive Management Plan in the Environmental Addendum. Compensatory conservation measures for VELB would be accomplished at a mitigation area on-site. Compensatory measures to offset impacts to GGS upland and aquatic habitat, delta smelt and its designated critical habitat, California CV steelhead DPS and its designated critical habitat, North American green sturgeon Southern DPS and its designated critical habitat, and CV spring-run Chinook salmon ESU. USACE would purchase credits at a local conservation bank for impacts to GGS uplands and aquatic habitat, riparian, SRA, Delta smelt shallow water, open water, and wetland habitats. Table 8-3 displays mitigation, including to offset impacts on Federally listed species. Compensatory mitigation recommended as part of this project is included in the Habitat Mitigation, Monitoring and Adaptive Management Plan in the Environmental Addendum.

Compensatory Mitigation

Compensatory mitigation that is not required as part of ESA compliance was developed consistent with USACE mitigation policy and requirements specified in ER 1105-2-100, Appendix C. The goal is no net loss of habitat functions and values. This includes mitigation for impacts to riparian habitat and wetlands. Compensatory mitigation would be implemented on site where feasible, and through purchase of mitigation bank credits off-site. Table 8-3 displays mitigation, including to offset impacts on Federally-listed species. Compensatory mitigation recommended as part of this project is included in the Habitat Mitigation, Monitoring and Adaptive Management Plan in the Environmental Addendum.

Table 8-3: Environmental Impacts and Compensatory Mitigation for the Recommended Plan

Habitat Type	Potential Impacts	Duration of Impact	Mitigation/ Compensation (Acres/Linear Feet)	Mitigation Cost
GGS Upland GGS Aquatic	111.5 Acres 6 Acres	Single Construction Season	111.5 acres site restoration 6 acres site restoration	Hydroseeding/ Relocation of drains – Construction Cost
GGS Upland GGS Aquatic	12.5 Acres 0.5 Acres	Permanent	35.12 acres bank credit 1.5 acres bank credit	$2,107,200 $90,000
Riparian	139 Acres	Permanent	72.13 bank credits	$5,409,750
Shaded Riverine Aquatic Habitat (ESA Fish Species)	19,630 LF	Permanent	58,890 bank credits	$5,594,550
Shallow Water Habitat (ESA Fish Species)	234 Acres	During operation of closure structure	123 acres bank credit	$15,990,000
Elderberry Shrubs	41 Shrubs/ 96 stems	Permanent	14 Acres created onsite, plus monitoring and adaptive management[1]	$2,040,000
Open Water	4 Acres	Temporary	2 acres bank credits	$260,000
Wetlands	10.75 Acres	Permanent	7.68 bank credits	$998,400
			Total	**$32,742,000***
			Total w/ Contingency	**$45,184,000**

*Monitoring and adaptive management costs are included in the elderberry shrub compensation line item. There are no additional monitoring or adaptive management costs associated with the other habitat types since they will be acquired through the purchase of mitigation bank credits. Monitoring and adaptive management costs are detailed in Addendum J.

8.1.3 OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION

Existing project levees have continuing OMRR&R obligations, manuals and agreements. The local sponsors coordinated with the responsible OMRR&R districts and agencies of the RP levees. Annual OMRR&R cost is estimated to be $1,062,000 including an estimate for addressing subsidence. Some primary OMRR&R responsibilities and factors evaluated are listed below.

- Cutoff wall will not change long-term maintenance or replacement costs.
- Closure structures will increase management maintenance costs.
- Wet penetration encroachments will be improved or replaced along the entire levee reaches.
- Dry encroachments such as power poles and vegetation will be reduced.
- Right-of-way will be increased; so maintenance costs will increase to cover a larger vegetation management footprint.
- Life cycle vegetation management maintenance costs will increase.
- Localized ground subsidence may require periodic placement of levee fill to maintain the levee crest elevation. The rate of subsidence would need to be evaluated during PED.

Upon construction completion, the project levees would again be turned over to the CVFPB with an amended OMRR&R manual and a revised agreement. The updated/revised documents will clearly articulate NFS requirements with specific emphasis on vegetation, burrowing animals and encroachments that have historically been problematic. The NFS would then be responsible for the continued OMRR&R of the levees with any amendments under the amended OMRR&R manuals and newly signed agreements. Compliance with the amended manuals and agreements will be enforced through the Levee Safety Program inspections and participation in the PL 84-99 program. Additional detail on the OMRR&R requirements can be found in Appendix B: Engineering.

The design elevation would be maintained by the sponsor through normal operation and maintenance activities over the 100 year project life. As part of Operation and Maintenance the sponsor would be required to verify the crest elevation by conducting a high order survey every 10-years to update the National Levee Database. The sponsor would be required to restore the levee profile if it was found to have subsided more than 0.5 feet. This approach to addressing subsidence related issues is described as the "Managed adaptive approach" in ETL 1100-2-1. It is estimated the crest elevation would need to be restored every 25 years for reaches that subsided at the high rate and 50 years for reaches that subsided at the medium rate. No restoration would be anticipated for reaches that subsided at the low rate.

Monitoring and Adaptive Management

Overall, after implementing mitigation components, the mitigation sites would be monitored until success criteria specified in the HMMAMP are met and as specified in BO Terms and Conditions. Monitoring costs are estimated to be approximately $250,000 for five years of monitoring post-construction. Monitoring would be both quantitative and qualitative and would be conducted by a qualified ecologist, botanist, or biologist. The monitor would be objective and independent from the contractor responsible for maintenance of the site. Monitoring for endangered species would be performed in accordance with USFWS and NMFS guidelines. If the monitoring results shows that the mitigation site is not meeting its success criteria, as established in the HMMAMP (Environmental Addenda J), then adaptive management measures may be required. These measures are established and described in the HMMAMP. Adaptive management, if required, is estimated to cost approximately $599,700 over five years.

The combined monitoring and adaptive management costs at October 2017 price levels, as included in the certified total project cost summary under the 06 "fish and wildlife facilities" account, totals $70,904,000 for the Recommended Plan. These costs are proposed to be cost-shared rather than included as a non-Federal O&M cost, because all mitigation being created is associated with the terms and conditions of the USFWS BO that was issued to USACE. These costs are included in the mitigation costs for impacts to elderberry shrubs, as displayed in Table 8-3, above. An annual report will document monitoring results will be provided to the project partners (USACE, CVFPB, SJAFCA) USFWS, NMFS, and CDFW.

8.1.4 REAL ESTATE

Acquisition of 14 acres in fee title along with 24 acres of temporary work easements would be required for the RP (Table 8-4). The NFS would acquire these lands as part of the project. Additional easements for flood protection levees, roadways and channel improvements total 232 acres. Real estate acquisition for the RP is split among 427 landowners with the majority of the land owned by individuals. Facility and utility relocations are estimated to be about $108,447,000, which would consist of approximately 113 permanent relocations (PL 91-646), and relocation of affected utilities and infrastructure. No cost or credit was included for LERRDs provided for any previous USACE project. Further details are located in Appendix C: Real Estate.

Table 8-4: Recommended Plan Lands, Easements and Rights-of-Way

Estate Type	Acres (Approximate)
Flood Protection Levee Easement	194
Roadway Easement	36
Channel Improvement Easement	2
Fee	14
Temporary Work Easements	24

8.1.5 PLAN ECONOMICS AND COST SHARING

The project first cost, estimated on the basis of 2017 price levels, totals $1,070,309,000. Table 8-5 displays each cost by project feature. Estimated average annual costs of $49,295,000 were based on a 2.75% percent interest rate, an analysis period of 50 years, and construction ending in 2033. Table 8-6 shows the project first costs. The total average annual flood damage reduction benefits are $345,024,000 with a net annual benefit of $295,730,000 and a benefit to cost ratio of 7.0 to 1.0.

Table 8-5: Estimated Costs of Recommended Plan ($1,000)

MCACES Account[2]	Description	Total First Cost[1]
01	Lands and Damages[3]	80,654
02	Relocations[4]	85,000
06	Fish and Wildlife	70,904
11	Levees and Floodwalls	566,599
15	Floodway Control and Diversion Structure	53,183
30	Planning, Engineering, Design[5]	144,901
31	Construction Management[6]	69,069
	Total First Cost[7]	1,070,309

Notes:
[1]Based on October 2017 price levels, 2.75% interest rate, and a 50-year period of analysis.
[2]Micro Computer-Aided Cost Engineering System (MCACES) is the software program and associated format used by USACE in developing cost estimates. Costs are divided into various categories identified as "accounts." Detailed costs estimates are presented in the Cost Engineering Addendum.
[3]Real Estate land costs, which include no damages.
[4]Relocations include relocating affected utilities and irrigation ditches.
[5]16 percent of 06, 11, and 15 accounts.
[6]10 percent of 06, 11, and 15 accounts.
[7] Numbers reported may be slightly different than those presented in the appendices due to rounding.

Table 8-6: Annual Costs and Benefits for Recommended Plan ($1,000)

First Costs	$1,070,309
Interest During Construction	$231,829
Total Investment Cost	$1,302,138
Interest and Amortization[1]	$48,232
OMRR&R	$1,062
Total Annual Cost	$49,294
Total Annual Benefits	$345,024
Net Annual Benefits	$295,730
Benefit to Cost Ratio	7.0

[1] October 2017 price levels, 2.75% interest rate and a 50 year period of analysis.

Table 8-7: Summary of Cost Sharing Responsibilities for the Recommended Plan ($1,000s) Working Level Estimates

MCACES Account	Item	Federal[1,2]	Non-Federal[1]	Total[1]
01	Lands and Damages[3]	10,675	69,979	80,654
02	Relocations	0	85,000	85,000
06	Fish and Wildlife Facilities	70,904	0	70,904
11	Levees and Floodwalls	566,599	0	566,599
15	Flood Control and Diversion Structure	53,183	0	53,183
30	Planning, Engineering, Design	144,901	0	144,901
31	Construction Management	69,069	0	69,069
	Subtotal	**907,575**	**154,979**	**1,070,309**
	Minimum 5% Cash Contribution		53,515	
	Additional Cash Contribution	(219,629)	219,629	
	Subtotal (NED Plan Cost Sharing)	695,701	374,608	
	Cost Sharing (%)	65	35	100
	Total (NED Plan Cost Sharing)[4]	**695,701**	**374,608**	1,070,309

Notes:
[1] October 2017 price levels, 2.75% interest rate, and a 50-year period of analysis.
[2] Federal Project First Costs are based on 65% of the NED Plan of $1,070,309,000.
[3] Lands, Easements, Rights of Way, Relocations and Disposal Areas.
[4] Numbers reported may be slightly different than those presented in the appendices due to rounding.

8.1.6 RISK AND UNCERTAINTY

In general, the ability of the plan to provide the expected accomplishments depends on the following: the validity of pertinent assumptions, base data, and analytical techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate OMRR&R after construction.

There is an estimated 83 percent reduction in economic flood risk. With the RP in place, the North Stockton impact area improves from a 15% annual chance of flooding in the highest risk areas to less than 1% annual chance. The Central Stockton impact area improves from a 12% annual chance of flooding in the highest risk areas to a 2% annual chance. Further information about specific AEP and the performance of levees for a range of hydrologic events within sub-impact areas can be found in Appendix A: Economics .

8.1.7 RESIDUAL RISK

Residual risk is the risk of inundation in the study area after the implementation of the RP. This risk would be in the form of overtopping or flanking of levees during very infrequent events. The RP greatly reduces the risk of flooding within the city of Stockton and areas immediately adjacent. With the RP in place, residual risk is driven by flooding from the Calaveras River and Diverting Canal, which were not improved. The estimated residual annual economic damages for the RP are $66,449,000. It is anticipated that the residual risk would increase over time, due to sea level change. The 2014 Lower San Joaquin River and Delta South Regional Flood Management Plan describes measures and plans the non-Federal sponsor can provide to further reduce residual risk, through non-structural efforts such as flood warning systems and evacuation services. Currently, San Joaquin County has evacuation routes mapped online for the entire study area, along with flood zone maps, hazard maps and personal readiness checklists. The 2014 plan also recommends improvements to the San Joaquin Alert System, establishing a flood fight supply system and training, and establishing mutual aid policies. These plans are routinely updated based on assessments of changing conditions within the County. As part of the NFS's responsibilities in undertaking this project, they are required to publicize floodplain information in the area and provide this information to zoning and other regulatory agencies for use in adopting regulations, or taking other actions to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

The potential for induced flooding from the RP was evaluated by comparing with-project and no action plans throughout the system. USACE policy allows mitigation for induced flooding to be recommended as a project feature when it is economically justified or there are overriding reasons of safety, economic or social concerns, or a determination of a real estate taking has been made (ER 1105-2-100, para.3- b.(5)). It was determined that the changes were not significant and no mitigation features would be required.

8.1.8 EXECUTIVE ORDER 11988

To comply with E.O. 11988, projects are formulated and recommended that, to the extent possible, avoid, minimize and/or mitigate adverse effects associated with use of the floodplain, and avoid inducing incompatible development in the floodplain unless there is no practicable alternative. Achieving flood and coastal storm risk management objectives generally cannot avoid locating actions in riverine or coastal floodplains. The requirements below are consistent with the EO 11988 decision process displayed in Figure 8-1 in Water Resources Council, Floodplain Management Guidelines for Implementing EO 11988, February 10, 1978 (43 FR 6030).

ER 1165-2-26 provides the general guidance and policy for USACE's implementation of EO 11988 for all civil works projects. Paragraph 7 of the regulations states: "It is the policy of the Corps of Engineers to formulate projects which, to the extent possible, avoid or minimize adverse impacts associated with use of the base floodplain and avoid inducing development in the base floodplain unless there is no practicable

alternative. The decision on whether a practicable alternative exists will be based on weighing the advantages and disadvantages of floodplain sites and non-floodplain sites. Factors to be taken into consideration include, but are not limited to, the functional need for locating the development in the floodplain. The test of practicability will apply to both the proposed Corps action and to any induced development likely to be caused by the action."

Based on the analysis conducted in Chapter 3, Section 3.6, Alternative 7a, the RP is compliant with the EO.

8.1.9 ENVIRONMENTAL OPERATING PRINCIPLES

The RP supports each of the seven USACE Environmental Operating Principles (EOPs). The EOPs are:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all USACE activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our responsibility and accountability under the law for activities undertaken by USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The environmental operating principles are met in the following ways:

Environmental balance and sustainability (EOP 1, 2, 3, &4)

Project avoids or minimizes environmental impacts while maximizing future safety and economic benefits to the community.

Planning with the environment (EOP 1, 2, 4, and 5)

Worked with local resource agencies during planning phase to minimize impacts to the environment.

Integrate scientific, economic, and social knowledge base (EOP 6)

All pertinent, best available information was used during plan formulation and selection.

Seeks Public input and Comment (Win-win solutions) (EOP 7)

Held stakeholder meetings and public workshops throughout the process.

Worked with local groups to achieve a balance of project goals and public concerns.

8.1.10 USACE CAMPAIGN PLAN

The mission of USACE is to provide vital public engineering services in peace and war to strengthen the Nation's security, energize the economy and reduce risks from disasters. In order to meet this mission, the agency has developed the USACE Campaign Plan (FY13-18) as a component of the corporate strategic

management process to establish priorities, focus on the transformation initiatives, measure and guide progress, and adapt to the needs of the future. The goals of the Campaign Plan are:

Goal 1 - Support National Security
Objective 1a – Support Combatant Commands and other U.S. government agencies
Objective 1b – Partner with Installation Management Communities
Objective 1c – Achieve National/Army energy security and sustainability goals
Objective 1d – Support the Engineer Regiment

Goal 2 - Transform Civil Works
Objective 2a – Modernize the Civil Works project planning program and process
Objective 2b – Enhance Civil Works budget development with a systems Watershed–Informed approach
Objective 2c – Deliver quality solutions and services
Objective 2d – Deliver reliable, resilient and sustainable infrastructure systems

Goal 3 - Prepare for Tomorrow
Objective 3a – Enhance interagency disaster response and risk reduction capabilities
Objective 3b - Enhance interagency disaster recovery capabilities
Objective 3c - Enhance interagency disaster mitigation capabilities
Objective 3d – Strengthen Domestic Interagency Support

Goal 4 - Reduce Disaster Risk
Objective 4a – Maintain and advance DoD and Army critical enabling technologies
Objective 4b – Build trust and understanding with strategic engagement, communication, and cyber-security
Objective 4c – Streamline USACE business, acquisition and governance processes
Objective 4d – Build ready and resilient people and teams through talent management / leader development

The RP is responsive to these goals and objectives by accomplishing the following:

Deliver reliable, resilient and sustainable infrastructure systems.

- Designing a project which avoids or minimizes environmental impacts while maximizing future safety and economic benefits to the community.

Deliver quality solutions and services.

- Designing a project which avoids or minimizes environmental impacts through fix-in-place levee alternatives while providing FRM for public safety of North and Central Stockton.

Build trust and understanding with strategic engagement, communication, and cyber-security.

- The Feasibility Study team organized and participated in stakeholder meetings and public workshops throughout the process and worked with local groups to achieve a balance of project goals and public concerns.

Build ready and resilient people and teams through talent management / leader development.

- The study successfully employed the use of District Quality Control, ATR, Risk Analysis, and IEPR to assist in the review of the development of a technically sound recommendation of Federal Interest.

8.2 PLAN IMPLEMENTATION

This section describes the remaining steps to potential authorization of the Project by Congress.

8.2.1 REPORT COMPLETION

The FR/EIS/EIR and DEIS/DEIR was circulated for public and agency review for 45 days. A public meeting was held for the public, agencies, and other interested parties on April 8, 2015. After completion of the public review period, comments have been considered and incorporated into the FR/EIS/EIR, as appropriate. The Final FR/EIS/EIR will be provided to any public agency that provided comments on the Draft Report. SJAFCA is responsible for certifying that the Final EIR has been prepared in compliance with CEQA.

8.2.2 REPORT APPROVAL

This Final FR/EIS/EIR will be circulated for 30 days to agencies, organizations, and individuals who have an interest in the proposed project. All comments received will be considered and incorporated into the Final FR/EIS/EIR, as appropriate. This project is being coordinated with all appropriate Federal, State, and local government agencies. USACE HQ will coordinate the public comments, receive comments from affected Federal and State agencies, and complete its own independent review of this final report.

After its review of the Final FR/EIS/EIR, including consideration of public comments, USACE HQ will prepare the Chief of Engineers' Report. This report will be submitted to the Assistant Secretary of the Army for Civil Works (ASA(CW)), who will coordinate with the Office of Management and Budget and submit the report to Congress.

8.2.3 PROJECT AUTHORIZATION AND CONSTRUCTION

Once the final report is approved by the Chief of Engineers and if the project is authorized by Congress, construction funds must be appropriated by Congress before a PPA can be signed by USACE and the NFS to begin construction.

The following tables disclose the expected project construction schedule and anticipated economic benefits by construction year. Since the Delta Front represents the greatest risk, construction of the project would begin with the Delta Front levees.

Implementation Strategy

Construction of the Recommended Plan is estimated to take 14 years under optimum funding. Preconstruction Engineering and Design (PED) for the Delta Front levee work would begin in 2021 with construction being initiated in 2025 and finishing in 2029. The Fourteen Mile Slough Closure Structure would also be designed in 2021 with its construction beginning in 2025 and finishing in 2026.

North Stockton features would begin PED in 2023 with construction being initiated in 2027 and being completed in 2028.

PED for the right bank of the Calaveras River would begin in 2025. Construction would begin in 2029 and be completed by 2031.

RD 404 and Duck Creek levees would begin PED in 2026 with construction being initiated in 2030 and being completed by 2032.

The Smith Canal Closure Structure would being PED in 2027 with construction taking place between 2031 -2032.

PED for the left bank of the Calaveras River would be initiated in 2028 with construction beginning in 2032 and lasting two years.

This construction schedule represents a forecast of optimal funding whereby the limiting factors are not budgetary but are construction resource availability, windows for environmental compliance, or on-site limitations.

TABLE 8-8: INTEREST DURING CONSTRUCTION‡ RECOMMENDED PLAN - NORTH STOCKTON (INCLUDING DELTA FRONT) ($1,000)

YEAR	PRESENT WORTH FACTOR	COSTS PRIOR TO BASE	PRESENT VALUE OF COSTS	INTEREST
2021	1.442297	$62,203	$89,715	$27,513
2022	1.403695	$62,203	$87,314	$25,111
2023	1.366127	$62,203	$84,977	$22,774
2024	1.329564	$62,203	$82,703	$20,500
2025	1.293979	$62,203	$80,490	$18,286
2026	1.259347	$62,203	$78,335	$16,132
2027	1.225642	$62,203	$76,239	$14,036
2028	1.192839	$62,203	$74,198	$11,995
2029	1.160914	$62,203	$72,212	$10,009
2030	1.129843	$62,203	$70,280	$8,077
2031	1.099604	$62,203	$68,399	$6,196
2032	1.070174	$0	$0	$0
2033	1.041532	$0	$0	$0
2034	1.013657	$0	$0	$0
TOTAL		$684,233	$864,862	$180,629

‡ Interest calculated using FY2018 discount rate of 2.75%

TABLE 8-9: INTEREST DURING CONSTRUCTION‡ RECOMMENDED PLAN - CENTRAL STOCKTON ($1,000)

YEAR	PRESENT WORTH FACTOR	COSTS PRIOR TO BASE	PRESENT VALUE OF COSTS	INTEREST
2026	1.259347	$42,897	$54,023	$11,125
2027	1.225642	$42,897	$52,577	$9,679
2028	1.192839	$42,897	$51,169	$8,272
2029	1.160914	$42,897	$49,800	$6,903
2030	1.129843	$42,897	$48,467	$5,570
2031	1.099604	$42,897	$47,170	$4,273
2032	1.070174	$42,897	$45,908	$3,010
2033	1.041532	$42,897	$44,679	$1,782
2034	1.013657	$42,897	$43,483	$586
TOTAL		$386,073	$437,276	$51,200

‡Interest calculated using FY2018 discount rate of 2.75%

TABLE 8-10: BENEFITS DURING CONSTRUCTION‡ RECOMMENDED PLAN($1,000)

YEAR	FEATURES CONSTRUCTED	PRESENT WORTH FACTOR	BENEFITS PRIOR TO BASE	PRESENT VALUE OF BENEFITS
2021-2024	PED, INVESTIGATIONS, RE ACQUISITIONS FOR DELTA FRONT	-	$0	$0
2023-2026	PED, INVESTIGATIONS, RE ACQUISITIONS FOR NORTH STOCKTON	-	$0	$0
2025	CUTOFF WALLS/LEVEE WORK ON DELTA FRONT FM_60_L; FOURTEENMILE SLOUGH CLOSURE STRUCTURE	-	$0	$0
2026	CUTOFF WALLS/LEVEE WORK ON DELTA FRONT FM_40_L; PED, RE ACQUISITION FOR CENTRAL STOCKTON; FOURTEENMILE SLOUGH CLOSURE STRUCTURE COMPLETE	-	$0	$0
2027	CUTOFF WALLS/LEVEE WORK ON DELTA FRONT FM_30_L;	-	$0	$0
2028	CUTOFF WALLS/LEVEE WORK ON DELTA FRONT FM_30_L	-	$0	$0
2029	COMPLETE DELTA FRONT LEVEE WORK; CUTOFF WALLS/LEVEE WORK ON N. STOCKTON MC_10_L; CR_10_R; CR_20_R TO CR_60_R; SEISMIC ON TS_10_L	-	$0	$0
2030	CUTOFF WALLS/LEVEE WORK ON N. STOCKTON CR_50_R, CR_60_R, TO CR_80_R;	-	$0	$0
2031	CUTOFF WALL/LEVEE WORK ON C. STOCKTON SJR_30_R TO SJR_60_R; SJR_70_R; FCS_10_R TO DC_10_R; NORTH STOCKTON LEVEE WORK COMPLETE; SMITH CANAL CLOSURE STRUCTURE BEGINS	-	$0	$0
2032	CUTOFF WALL/LEVEE WORK ON C. STOCKTON CR_10_L TO CR_30_L; CR_40_L TO CR_70_L; SJR_10_R; SMITH CANAL CLOSURE STRUCTURE COMPLETE	1.084790	$245,469	$266,283
2033	CUTOFF WALL/LEVEE WORK ON C. STOCKTON COMPLETE SJR_30_R TO SJR_60_R; SJR_70_R; FCS_10_R TO DC_10_R	1.055756	$245,469	$259,156
2034	DEMOBILIZATION AND PUNCHLIST	1.027500	$245,469	$252,220
2035	CONSTRUCTION COMPLETE	1.000000	$0	$0
	TOTAL		$736,407	$777,659

† Interest calculated using FY2018 discount rate of 2.75%

8.2.4 DIVISION OF RESPONSIBILITIES

Federal Responsibilities

USACE would accomplish PED studies. Once the project is authorized and funds are appropriated, a PPA would be signed with SJAFCA and CVFPB as the NFS. After the sponsors provide the cash contribution, lands, easements, rights-of-way, relocations, and disposal areas, as well as assurances, the Federal Government would begin construction of the project.

Non-Federal Responsibilities

Specific items of local cooperation are identified in Chapter 9.

Views of Non-Federal Sponsor
The NFS, SJAFCA and the CVFPB, support the RP. Throughout development of this feasibility report, there has been significant coordination with SJAFCA, the State of California, San Joaquin County, and other stakeholders.

Financial Capability of Sponsor
The total estimated non-Federal first cost of the project is $374,608,000 including LERRDs using 2017 price levels. Actual costs may be slightly greater at the time of construction due to inflation. The total estimated value for the project lands, including LERRDs, is $165,654,000. The NFS will be required to provide self-certification of financial capability for the final report as required by USACE guidance.

Project Cost-Sharing Agreements
Prior to PED, a Design Agreement must be executed between USACE and the NFS in order to cost share the development of detailed plans and specifications. Before construction is started, USACE and the NFS would execute a PPA. This agreement would define responsibilities of the NFS for project construction as well as OMRR&R, and other assurances. The scope for this project includes OMRR&R directly required for project features defined in this report as well as indirectly required to ensure the ongoing operation of the project as designed. Should both SJAFCA and the CVFPB sign the PPA, the two parties would be subject to several joint liabilities for compliance, with the obligations embodied by the agreement. However, the PPA would further designate CVFPB as the party physically responsible for OMRR&R of this project. If either SJAFCA or the CVFPB is a sole signatory of the PPA, that agency would assume OMRR&R responsibilities for the components of this project.

8.3 SCHEDULE

If the project is authorized in 2017, construction activities could start as early as 2019. Table 8-11 contains a schedule showing the approval and construction phases of the project.

Table 8-11: Project Schedule

Phase	Scheduled Dates
Division Commander's Transmittal to HQ USACE	2017
Chief of Engineers Report	2018
Potential Authorization	2019
USACE and Sponsor Sign Design Agreement	2019
Preconstruction Engineering and Design	2020-2023
USACE and Sponsor Sign Project Partnership Agreement	2021
Initiate Construction	2025
Complete Physical Construction	2033

8.4 FURTHER STUDIES

During the PED phase, several additional studies would be conducted as part of developing detailed designs for the project. These studies include:

- Additional geotechnical analysis of underlying substrates and estimate potential localized subsidence rates.
- Additional hydraulic analysis including most current modeling data. Additional localized erosion and related sedimentation analysis during design of project features. Use of the analysis of sedimentation and erosion regime in the study area indicates little likelihood of departure in sedimentation behavior from the existing conditions for the proposed measures that would affect plan selection. It is, therefore, not likely that sediment will have significant impacts on project construction or performance.
- Activities that would be required to do the risk based analysis of vegetation on the levees for a vegetation variance include: determine species of trees present in the proposed variance zone; determine maximum size that the trees would grow to; root ball size analysis for the trees once fully matured; analysis of the amount of additional scour that could occur in a flood event; seepage and stability analysis; and development of cross-sections illustrating the trees, root systems, and levee prism.
- Topographic and ground surveys for project design.
- Preconstruction surveys to avoid direct impacts to nesting birds and other sensitive species.
- Water quality analysis of construction activities and methods.
- A Phase I Environmental Site Assessment to identify potential hazardous materials and wastes within the project area.
- Intensive cultural resources survey, evaluations, and mitigation as appropriate, in consultation with SHPO, and Native American Tribes; as specified in the PA.

As mentioned in Chapter 1, this study would only partially address the San Joaquin River Basin Authority, and is therefore called an "Interim Feasibility Report" which indicates that the study is addressing the issues of a specific area within the authority rather than the entire area authorized for study. RD 17 is undertaking levee improvements to address through and underseepage of the existing levee system. Upon completion of that work, RD 17 intends to request USACE participation in achieving compliance with SB 5's urban standard of 200-year performance for the 0.5 percent ACE to address residual flood risk. Consideration of future Federal participation would be subject to the demonstration of Federal interest.

CHAPTER 9 — RECOMMENDATIONS

This chapter describes the Items of Cooperation for a Structural FRM (Single Purpose) Project that will be specifically authorized. I recommend that the Recommended Plan (Alternative 7a) be authorized for implementation, as a Federal project, with such modifications thereof as in the discretion of the Commander, USACE, may be advisable. The estimated first cost (2017 price level) of the Recommended Plan (RP) is $1,070,309,000 with an estimated Federal cost of $695,701,000 (includes $7,563,000 in cultural resources data recovery costs) and an estimated non-Federal cost of $374,608,000. The estimated annual OMRR&R cost is $1,062,000 (2017 price levels). Federal implementation of the RP would be subject to the NFS complying with applicable Federal laws and policies, including but not limited to:

a. Provide a minimum of 35 percent, but not to exceed 50 percent of total project costs as further specified below:

    1. Provide 35 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work;

    2. Provide, during construction, a cash contribution of funds equal to 5 percent of total project costs;

    3. Provide all lands, easements and rights-of-way, including those required for relocations, the borrowing of material and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction and O&M of the project;

    4. Provide, during construction, any additional funds necessary to make its total contribution equal to at least 35 percent of total project costs;

b. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

c. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

d. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

e. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within 1 year after the date of signing a project cooperation agreement, and to implement such plan not later than 1 year after completion of construction of the project;

f. Publicize floodplain information in the area and provide this information to zoning and other regulatory agencies for use in adopting regulations, or taking other actions to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

g. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements and rights-of-way or the addition of facilities that may reduce the level of protection the project affords, hinder O&M of the project, or interfere with the project's proper function;

h. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements and rights-of-way required for construction and O&M of the project, including those necessary for relocations, borrowing of material or disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies and procedures in connection with said Act;

i. For so long as the project remains authorized, OMRR&R the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations, and any specific directions prescribed by the Federal Government;

j. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

k. Hold and save the U.S. free from all damages arising from the construction, OMRR&R of the project and any betterments, except for damages due to the fault or negligence of the U.S. or its contractors;

l. Keep and maintain books, records, documents or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

m. Comply with all applicable Federal and State laws and regulations, including but not limited to: Section 601 of the Civil Rights Act of 1964 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); the Rehabilitation Act of 1973, as amended (29 U.S.C. 794) and Army Regulation 6007 issued pursuant thereto; and 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (labor standards originally enacted as the Davis-Bacon Act, the Contract Work Hours and Safety Standards Act, and the Copeland Anti-Kickback Act);

n. Perform, or ensure performance of, any investigations that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on or under lands, easements or rights-of-way that the Federal Government determines to be required for construction and O&M of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;

o. Assume, as between the Federal Government and the NFS, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on or under lands, easements or rights-of-way that the Federal Government determines to be required for construction and O&M of the project;

p. Agree, as between the Federal Government and the NFS, that the NFS shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, OMRR&R the project in a manner that will not cause liability to arise under CERCLA; and

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project, or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to Congress as proposals for authorization and implementation funding. However, prior to transmittal to Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

29 August 2017
Date

David G. Ray, P.E.
Colonel, U.S. Army
District Commander

CHAPTER 10 — LIST OF RECIPIENTS

The following Federal, State and local agencies and organizations will either receive a copy of the Final FR/EIS/EIR, or a notification of the document's availability. Individuals who may be affected by the project or have expressed interest through the public involvement process will also be notified. The notification will provide the location of hardcopies and a web address for accessing an electronic version. Comments received during the 30-day public and agency comment period will be reviewed and considered in preparation of the Final FR/EIS/EIR.

10.1 ELECTED OFFICIALS AND REPRESENTATIVES

Governor of California
Honorable Edmund G. Brown

United States Senate
Honorable Barbara Boxer
Honorable Dianne Feinstein

United States House of Representatives
Honorable Jeffery Denham

California State Senate
Honorable Anthony Cannella

California State Assembly
Honorable Cathleen Galgiani

San Joaquin County
Supervisor Carlos Villapudua (Vice-Chairman) (District 1)
Supervisor Katherine Miller (District 2)
Supervisor Tom Patti (District 3)
Supervisor Chuck Winn (District 4)
Supervisor Bob Elliot (Chairman) (District 5)

City of Stockton
Mayor – Michael Tubbs
Vice Mayor Elbert Holman Jr. (District 1)
Councilmember Dan Wright (District 2)
Councilmember Susan Lofthus (District 3)
Councilmember Susan Lenz (District 4)
Councilmember Christina Fugazi (District 5)
Councilmember Jesus Andrade (District 6)

City of Lathrop
Mayor Sonny Dhaliwal
Vice Mayor Paul Akinjo
Councilmember Martha Salcedo
Councilmember Steve Dresser
Councilmember Mark Elliott

City of Manteca
Mayor Steve DeBrum
Councilmember Rich Silverman
Councilmember Gary Singh
Councilmember Debby Moorhead
Councilmember Mike Morowit

10.2 FEDERAL GOVERNMENT AGENCIES

- Council on Environmental Quality
- Federal Emergency Management Agency
- National Marine Fisheries Service
- Natural Resources Conservation Service
- U.S. Bureau of Reclamation
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

10.3 STATE OF CALIFORNIA GOVERNMENT AGENCIES

- California Air Resources Board
- California Bay-Delta Authority
- California Department of Conservation
- California Department of Fish and Game
- California Department of Parks and Recreation
- California Department of Transportation
- California Department of Water Resources
- California State Clearinghouse
- California State Lands Commission
- California State Office of Historic Preservation
- California State Water Resources Control Board
- Central Valley Flood Protection Board
- Central Valley Regional Water Quality Control Board
- Governor's Office of Emergency Services
- Native American Heritage Commission

10.4 REGIONAL, COUNTY, AND CITY AGENCIES

- City of Lathrop
- City of Manteca
- City of Stockton
- San Joaquin County
- San Joaquin Area Flood Control Agency (SJAFCA)
- RD 1608 – Smith Tract
- RD 1614 – Smith Tract
- RD 17 – Mossdale Tract
- RDD 2074 – Sargent Barhardt Tract
- RD 2042 – Bishop Tract
- Water Resources Control Board, Central Valley Region

10.5 NATIVE AMERICAN TRIBES

- Wilson Rancheria
- Nototomne/Northern Valley Yokuts
- California Valley Miwok tribe
- Ione Band of Miwok Indians
- United Auburn Indian Community
- Buena Vista Rancheria Me-Wuk Indians

CHAPTER 11 — LIST OF PREPARERS

This report was prepared by the USACE, Sacramento District, with participation from ESA consulting, California DWR and the SJAFCA. The following sections identify individuals who prepared technical analyses, wrote sections of the Draft Report or provided technical or policy review of the final report.

11.1 USACE

Name	Title	Education/Experience	Role in Report
Anne Baker	Social Science Environmental Manager	B.A. English; 7 years USACE	NEPA/CEQA Analysis & Report Writing
Peter Blodgett, P.E.	Civil Engineer	B.S. Civil Engineering; California Licensed Civil Engineer; 18 years USACE	Hydraulics and Flood Risk Analysis, Technical Appendix Preparation, NEPA/CEQA Analysis and Report Writing (H&H)
Anne L. Burman	Deputy District Council, Civil Works and Real Estate	J.D.; LL.M Environmental Law; 32 years Federal practice; 21 years environmental law practice	Legal review of Study and NEPA Documents
David Colby	Fisheries Biologist	B.S. Freshwater Fisheries; 1 year USACE; 10 years U.S. Fish and Wildlife Service	NEPA/CEQA Analysis and Report Writing (Fisheries and Special Status Species)
Matt Davis	NEPA Regional Specialist	M.S. Biological Sciences; B.A. Zoology; 30 years' experience in environmental planning	NEPA/CEQA/ESA Technical Review
Benjamin F. Dorsinvil	Economist	MBA Finance; B.A. Economics; 2 years USACE	NEPA/CEQA Analysis and Report Writing (Socioeconomics and Environmental Justice)
William Doyle, P.E.	Civil Engineer	B.S. Civil Engineering; 4 years USACE	Engineering Technical Lead; Technical Appendix Preparation
James Elsberry	Civil Engineer	B.S. Civil Engineering; 4 years USACE	Civil Engineering Technical Appendix Preparation and Report Review

Name	Title	Education/Experience	Role in Report
Jerry Fuentes	Plan Formulation Regional Technical Specialist	M.A., B.A. Social Studies; 28 years USACE	Review Planner, Planner
Amanda Fuller	Assistant District Council	J.D.; B.A. Government, History, Philosophy	Real Estate Legal Reviewer
Victoria Hermanson	Biological Science Intern	B.S. Biology	Report Preparation
John High	Supervisory Hydrologist	B.A. Environmental Science; 16 years hydrologist	Technical Review (H&H)
Elizabeth Holland	Senior Social Science Environmental Manager	A.A. Social Science; 29 years USACE	NEPA/CEQA Analysis and Report Writing
Brad Johnson	Biological Science Environmental Manager	B.S. Landscape Architecture; 3 years USACE, Environmental	NEPA/CEQA Analysis and Report Writing (Special Status Species)
Glen Johnson	Civil Engineer	B.S. Civil Engineering	Geotechnical Engineer and Geotechnical Appendix Preparation
Hunter Merritt	Water Resources Planner	B.A. English Literature; M.S. Recreation Administration; 8 years USACE, Planning	Planner and Report Editing (all chapters); Transmittal Package to Senior Leader Briefing
Scott Miner	Ecosystem Restoration Specialist	M.S. Wildland Resource Science; 35 years USACE	Policy Review
Shaleatha Palmore	Technical Writer	B.A. English	Technical Editor, Report Preparation
Nikki Polson	Archaeologist	M.A. Anthropology; B.S. Anthropology; 5 years USACE; 15 years Archaeologist	Lead Cultural Resources and NEPA/CEQA Analysis and Report Writing (Cultural Resources)

Name	Title	Education/Experience	Role in Report
Glen Reed	Project Manager	M.S. Construction Management; B.S. Industrial Technology; 35 years U.S. Army/U.S. Air Force	Final Project Management and Report Review
Stacy Samuelson	Water Resources Planner	B.S. Natural Resource Management; B.S. Biology; 15 years USACE	Lead Planner and Report Writing (Chapters 1, 2, 3, 8, and 9)
Joana Saviñon	Project Manager	M.S. Biology; B.A. Environmental Studies; 7 years USACE, Project Management and Water Resources Planning	Initial Project Management and Report Review
Aaron Schlein	Regional Economist	B.A. Economics; 7 years USACE	Lead Economist and Consequence Analyst; Technical Appendix Preparation
Lynne Stevenson	Biological Science Environmental Manager	M.S. Water Science; MLS Library Science; B.A. Biological Science	NEPA/CEQA Analysis and Report Writing (Geology, Seismicity, Soils)
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Robert D. Vrchoticky Jr., P.E.	Civil Engineer	B.S. Civil Engineering; 13 years Civil Design Engineer; 9 years Hydraulic Design Engineer; 10 years Cost Engineer	Cost Engineering, Technical Appendix Preparation
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Casey Young	GIS Specialist	GIS Certificate; B.A. Geography; 7 years USACE; 3 years private	Lead GIS; Map and Figure Preparation

11.2 ESA CONSULTING

Name	Title	Education/Experience	Role in the Study
Erick Cooke	Senior Managing Associated	M.S. Environmental Coastal and Ocean Science; B.A. Biology; 16 years' experience	NEPA/CEQA Technical Review
Catherine C. McEffee	Vice President/Director	M.S. Environmental Policy Analysis and Planning; B.S. Water Science; 26 years' experience	NEPA/CEQA Technical Review
Tim Rimpo	Senior Air Quality Program Manager	M.S. Economics (Environmental and Natural Resources Specialization); B.A. Economics; 29 years' experience	NEPA/CEQA Analysis and Report Writing (Air Quality and Green House Gases)

11.3 CALIFORNIA DEPARTMENT OF WATER RESOURCES

Name	Title	Education/Experience	Role in the Study
Ruth Darling	Environmental Project Manager	B.S. Biology; 9 years' experience	CEQA Manager; CEQA Technical Review
Paul Larson	Water Resources Engineer	Water Resources Engineer	DWR, Project Management
Robert E. Scarborough	Section Chief, Flood Risk Reduction Projects Branch, Division of Flood Management	B.S Civil Engineering, 26 years private sector in Engineering, H&H, Waste Water, Water, Grading, Construction, Project and Program Management; 7 Years DWR Program Management	DWR Project Management Oversight

11.4 SJAFCA

Name	Title	Education/Experience	Role in the Study
James Giottonini	Executive Director	M.B.A., B.S. Civil Engineering; Professional Civil Engineer; 47 years' experience	Project Management
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Juan Neira	Project Manager	M.S. Civil Engineering, B.S. Civil Engineering; Professional Civil Engineer; 17 years' experience	Project Management

11.5 PETERSON BRUSTAD ENGINEERING, INC.

Name	Title	Education/Experience	Role in the Study
Dave Peterson, P.E.	Principal	B.S. and M.S. Civil Engineering; 33 years' experience	Engineering Consultant for SJAFCA

CHAPTER 12 — REFERENCES

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Lower San Joaquin River Feasibility Report

San Joaquin County, California

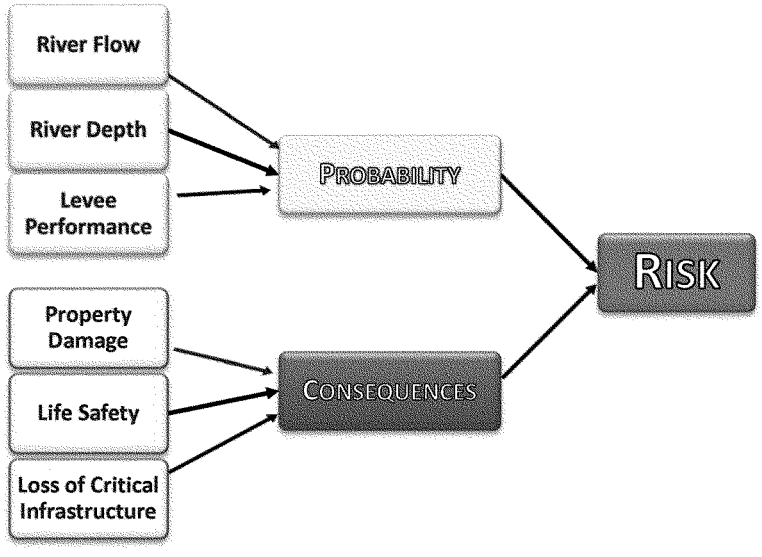
APPENDIX A: ECONOMICS

RISK ANALYSIS OVERVIEW

Risk is defined as the measure of the probabilities and consequences associated with uncertain future events. The objective of this economic analysis is to assess existing flood risk in the Lower San Joaquin River Basin and evaluate potential measures to reduce that risk.

The figure below provides a visual representation of the basic components driving the flood risk analysis summarized in this appendix. Each of these components will be described in detail in subsequent chapters.

COMPONENTS OF FLOOD RISK



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CHAPTER 1 — INTRODUCTION

1.1 PURPOSE & SCOPE

This Appendix documents the economic analysis conducted in support of the Lower San Joaquin River Feasibility Study (LSJRFS). The purposes of this report are:

- Describe major assumptions, data, methodologies, and tools used in the economic analysis
- Describe the flood risk associated with the without-project condition
- Describe the residual flood risk associated with each alternative.
- Summarize the net benefits and benefit-to-cost ratios of each alternative
- Identify the alternative that reasonably maximizes net benefits

1.2 STUDY AREA

The Lower San Joaquin study area is located in San Joaquin County, California, approximately 50 miles south of Sacramento. The geographical extent of the economic analysis was established using inundation boundaries of the 0.2% annual chance exceedance (ACE) events from the flooding sources described in Section 1.3 This analysis includes roughly 80 square miles of urban and agricultural lands in the communities of Stockton, Lathrop, and Manteca.

1.3 SOURCES OF FLOODING

The study area is susceptible to comingled flooding from six principal sources including the Sacramento-San Joaquin Delta, San Joaquin River, Mosher Slough, Calaveras River system, French Camp Slough system, and interior sources. Descriptions of each flood source can be found in Section 3.0 of the Hydraulic Design Addendum.

1.4 RELATED FEDERAL FLOOD RISK MANAGEMENT PROJECTS

Development of water resources in the basin began in the 1850s and currently includes large multiple-purpose reservoirs, extensive levee and channel improvements, bypasses, and local diversion canals (USACE, 1993). Numerous agencies have been involved in water resources development within the study area. Some of these agencies include the USACE, Bureau of Reclamation, the State of California, county irrigation districts, local reclamation districts, and local levee districts.

A discussion of existing Federal Flood Risk Management projects affecting the study area can be found in Section 3.0 of the Hydraulic Design Addendum.

1.5 SEPARABLE CONSEQUENCE AREAS

Flood risk in the study area was divided into three separable elements[1], or consequence areas, based on hydrologic and hydraulic characteristics with identifiable and distinct economic benefits. These Consequence areas are described below. A map of the Consequence area boundaries and existing levees is shown in Figure 1-1.

[1] "Separable element" is defined in 33 United States Code (U.S.C.) Section 2213(f) as a portion of the project that (1) is physically separable from other portions of the project; and (2)(a) achieves hydrologic effects, or (b) produces physical or economic benefits, which are separately identifiable from those produced by other portions of the project.

NORTH STOCKTON – The North Stockton area is defined by the right bank levees of the Calaveras River and the levees along the delta front traveling northward along Tenmile Slough, Fourteenmile Slough, crossing Fivemile Creek, and traveling north to tie into the Federal project levee across Mosher Slough at the Atlas Tract.

CENTRAL STOCKTON – The Central Stockton Area is defined by the left bank levees of the Stockton Diverting Canal, the left bank levees of the Calaveras River, the right bank levees of the San Joaquin River, and right bank levees of French Camp Slough.

RECLAMATION DISTRICT 17 (RD17) – The RD17 area is defined by the levees along the right bank of the San Joaquin River, the left bank levees of French Camp Slough, and a dry-land levee at the upstream end of the reclamation district.

1.5.1 SUBDIVISION OF CONSEQUENCE AREAS

The North Stockton and Central Stockton consequence areas were subdivided into damage reaches for economic analysis purposes. Total damages for each consequence area is the sum of damages in each reach. A map of the subdivided areas is shown in Figure 1-2.

FIGURE 1-1: CONSEQUENCE AREAS

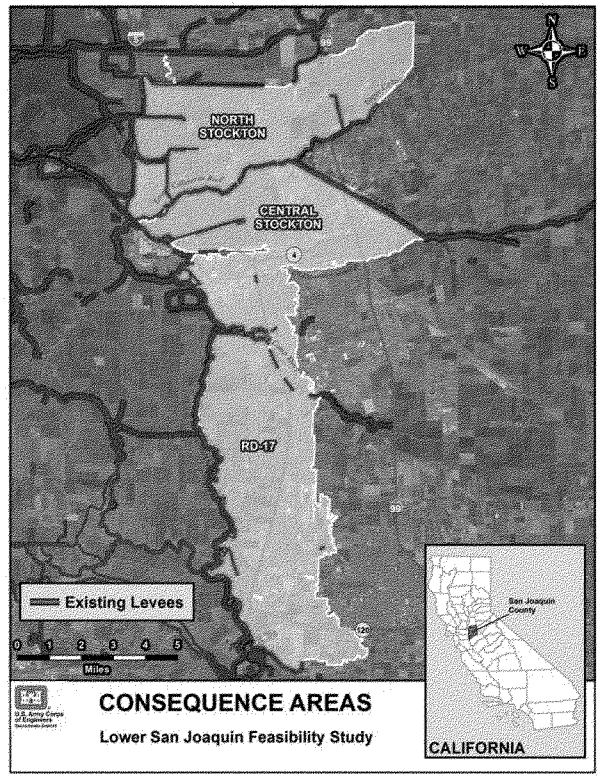
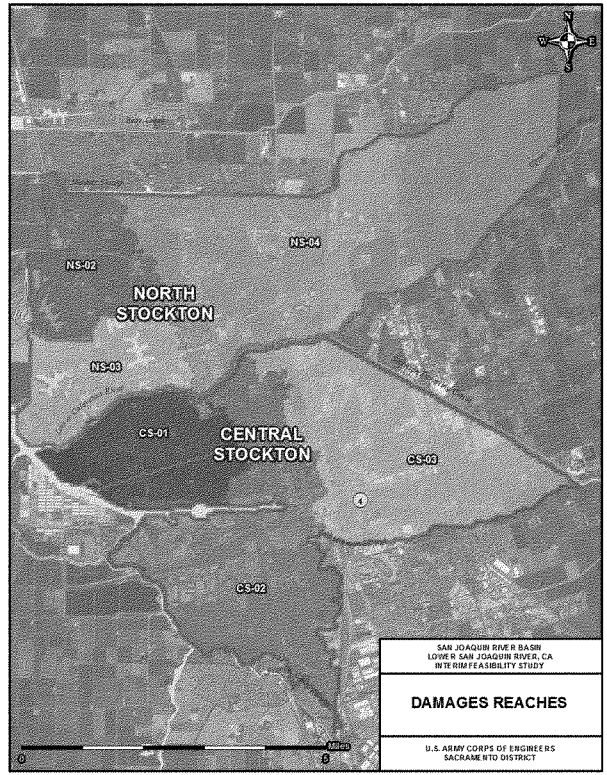


FIGURE 1-2: NORTH AND CENTRAL STOCKTON DAMAGE REACHES



1.6 POPULATION AT RISK

Population data for this study was obtained using a geographic information systems (GIS) layer containing 2010 census data by census block. This census data reports approximately 235,000 people residing within the study area in 2010. The population at risk (PAR) is comprised of individuals residing in an area that receives flooding for a given annual chance exceedance (ACE) event, regardless of inundation depth or levee performance (see section 2.6). PAR estimates do not include temporary population (*e.g.* individuals working or traveling in the area who live elsewhere).

The population at risk by ACE event is shown in Table 1-1. Reported values represent the number of people residing within the floodplain boundary for each event, regardless of inundation depth or levee performance.

TABLE 1-1: POPULATION AT RISK BY ANNUAL CHANCE EXCEEDANCE

POPULATION AT RISK BY ACE						
0.5	**0.10**	**0.04**	**0.02**	**0.01**	**0.005**	**0.002**
39,800	53,800	81,800	186,700	209,800	223,300	235,000

CHAPTER 2 — ECONOMIC ANALYSIS

2.1 CONSISTENCY WITH CURRENT REGULATIONS & POLICIES

The analysis presented in this document was performed using the most up-to-date guidance and is consistent with current regulations and policies. Various references were used to guide the economic analysis, including:

- The Planning Guidance Notebook (ER 1105-2-100, April 2000, with emphasis on Appendix D, Economic and Social Considerations, Amendment No. 1, June 2004) serves as the primary source for evaluation methods of flood risk management (FRM) studies
- EM 1110-2-1619, Engineering and Design – Risk-Based Analysis for Flood Damage Reduction Studies (August 1996)
- ER 1105-2-101, Planning Risk-Based Analysis for Flood Damage Reduction Studies (Revised January 2006)
- Economic Guidance Memorandum (EGM) 01-03, Generic Depth-Damage Relationships (2000)
- Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements (2003)
- Economic Guidance Memorandum (EGM) 09-04, Generic Depth-Damage Relationships for Vehicles (2009)

2.2 PRICE LEVEL, PERIOD OF ANALYSIS, AND DISCOUNT RATE

Values listed in this document are based on an October 2017 price level, unless otherwise noted. Annualized benefits and costs were computed using a 50-year period of analysis and a current federal discount rate of 2.75%. Unless otherwise noted, annualized values are presented in thousands of dollars.

2.3 HYDROLOGIC, HYDRAULIC, AND GEOTECHNICAL DATA

Flood inundation was modeled for eight ACE events at each breach location using FLO-2D software. FLO-2D stores the resulting inundation data for each model using an overlay of uniform grid cells. For this analysis, the maximum water surface elevation at each grid cell was used as an input into HEC-FDA to represent the inundation depth at each structure located within that cell.

The probability of flooding at a given breach location is driven by the following engineering inputs:

UNREGULATED FLOW PROBABILITY — the relationship between natural (unregulated) river flow and the probability of that flow being exceeded

UNREGULATED TO REGULATED FLOW TRANSFORM — the relationship between natural flow and regulated flow resulting from reservoir routing, channel routing, or channel diversion.

DISCHARGE-STAGE RELATIONSHIP — the relationship between regulated flow and corresponding river depth (stage)

GEOTECHNICAL PERFORMANCE — the relationship between river depth and the probability of levee overtopping and/or failure at that depth

2.4 SIMPLIFYING ASSUMPTIONS

Several assumptions were relied upon in order to make best use of scarce resources to reasonably and efficiently identify existing flood risk and evaluate potential solutions.

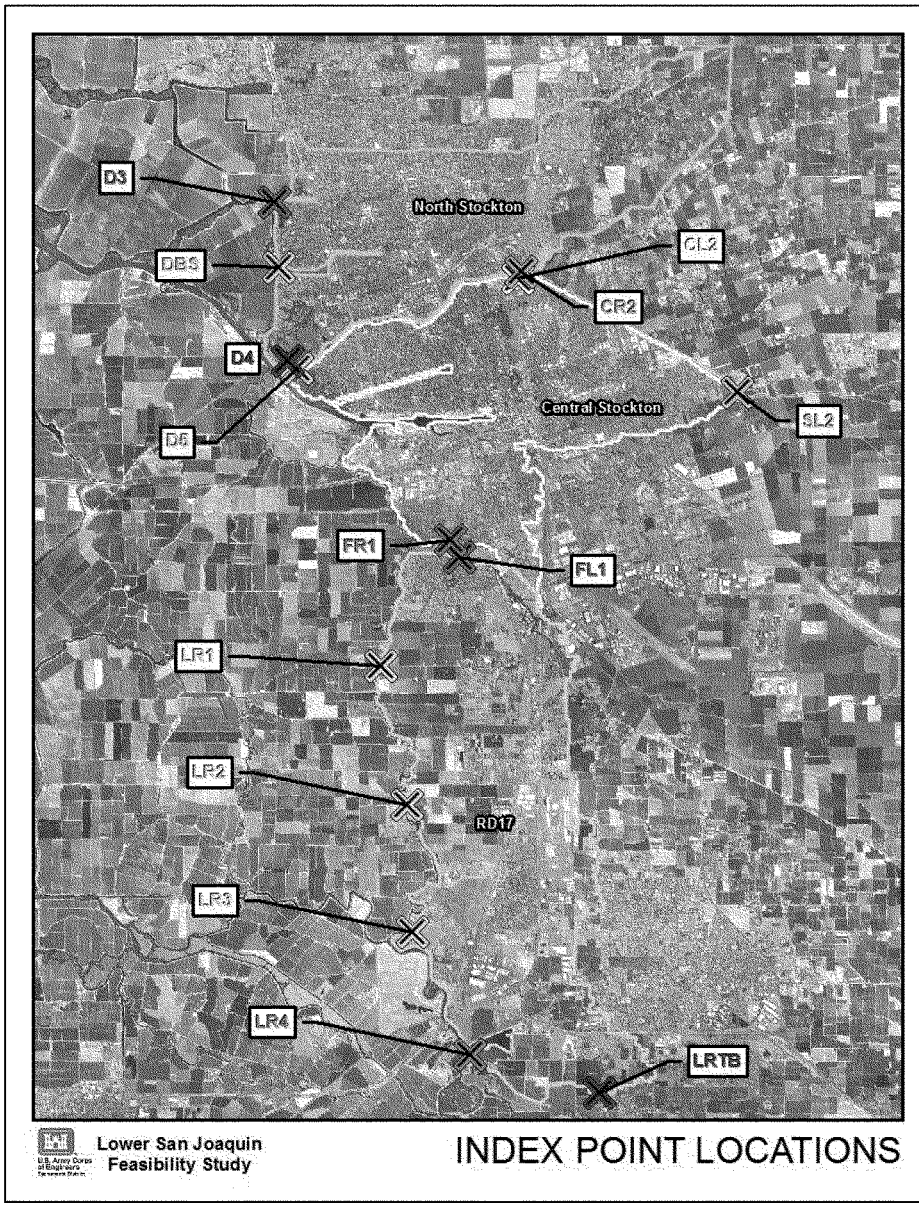
2.4.1 BREACH LOCATIONS

Existing levees in the study area were divided into 14 levee reaches. Breach and inundation characteristics of each levee reach were modeled using a representative index point. The use of index points is policy compliant and is considered the most reasonable method to efficiently model flood risk over a large geographical area. Index points are summarized geographically from upstream to downstream in Table 2-1 below. Figure 2-1 displays each of the index point locations.

TABLE 2-1: INDEX POINTS BY FLOODING SOURCE

FLOOD SOURCE	INDEX POINT
SAN JOAQUIN RIVER	LRTB
	LR4
	LR3
	LR2
	LR1
FRENCH CAMP SLOUGH	FR1-1
	FR1-2
	FL1
STOCKTON DIVERTING CANAL	SL2
CALAVERAS RIVER	CR2
	CL2
SACRAMENTO-SAN JOAQUIN DELTA FRONT	D3
	D4
	D5
	D-BS

FIGURE 2-1: INDEX POINT LOCATIONS



2.4.2 MULTIPLE-SOURCE FLOODING

Throughout this study, multiple sources of flooding exist within a single impact area. Each source has its own unique combination of probabilities and consequences. Within each impact area, the simplifying assumption was made that the flood source with the highest economic risk is deemed the driver of risk. If a feature of an alternative reduces the risk associated with one of the sources, the source with the next highest risk becomes the residual risk driver.

2.4.3 FUTURE WITHOUT-PROJECT CONDITION—ECONOMICS

For this feasibility study analysis, the future without-project condition assumes no additional development in the study area. The basis of this assumption is that existing developable land is reasonably built out to its full potential. Additionally, development forecasts were not made for currently undeveloped portions of the study area. This is due to the uncertainty surrounding public policy decisions that may limit or prohibit such development.

2.4.4 CLIMATE CHANGE

Sea level rise due to climate change is expected to impact stage-frequency at several breach locations in the study area. Stage-frequency relationships were adjusted for the future year condition based on sea level rise forecasts made in compliance with USACE EC 1165-2-212.

Hydraulic inputs for all alternatives use 2010 data to represent present-year conditions and forecasted data for the year 2070 to represent the future year. It is acknowledged that using 2010 data presents the risk of failing to capture sea level rise that may have already occurred. This risk is considered acceptable as the result is a slight underestimation of without-project damages and subsequent with-project benefits.

Please refer to the Hydraulic Design Addendum for a detailed account of the sea level rise analysis.

2.4.5 GEOTECHNICAL PERFORMANCE

Each geotechnical performance relationship curve represents the most likely levee failure mode for a given breach location. Performance relationships for all other potential failure modes are assumed to be captured within the most likely curve.

2.4.6 EQUIVALENT ANNUAL DAMAGES

All annual damages in this appendix are reported in average annual equivalent terms. Because sea level rise is expected to lead to an upward shift in the stage-frequency relationship, higher probabilities of flooding are expected in the future, all else being equal. To capture the consequent increase in expected annual damages, a linear relationship between future damage values was assumed. Future damages are interpolated between the base and future year and discounted back to the base year.

2.4.7 STRUCTURE LOCATIONS

Structure locations were estimated using a geographic information system (GIS) parcel layer containing the boundaries of every parcel of land in the study area. The spatial accuracy of the data was confirmed using aerial imagery. The simplifying assumption was made that structures are to be located at the geometric center, or centroid, of the parcel they are located on.

Figure 2-2 displays this structure placement process visually. It is important to note the location of the centroids in relation to the structures they represent.

FIGURE 2-2: STRUCTURE PLACEMENT

Aerial Imagery | Parcel Boundaries | Parcel Centroids

2.5 STRUCTURE INVENTORY DATA

An inventory of damageable property was developed for the study in two parts. The first part was completed in 2011 by USACE Los Angeles District for use in the 2012 preliminary screening analysis. This inventory was based on San Joaquin County Assessor parcel data and included 51,856 structures and covered most of the North and Central Stockton consequence areas. For consequence modeling purposes, each structure's value was computed as a function of replacement value minus depreciation.

The second part was developed in 2013 as a supplement to the existing inventory. This was critical to the study as the 2011 inventory did not include structures in RD17. Furthermore, a significant number of structures in North and Central Stockton were missing or inaccurately located. The supplementary inventory was also created using assessor parcel data, and structure values were computed by sampling the preliminary inventory and applying the weighted mean cost per square foot for each occupancy type to the supplementary inventory.

2.5.1 CONTENT-STRUCTURE VALUE RATIOS

The content to structure value ratio is the relationship between the value of a structure and the value of its contents. Content-structure value ratios are expressed as a percentage and are based on a structure's occupancy type.

The value of contents in residential structures was estimated using depth-damage functions and associated standard error estimates developed by the Institute for Water Resources (IWR).

The value of contents in non-residential structures was estimated using content-structure value ratios published in *Technical Report: Content Valuation and Depth Damage Curves for Nonresidential Structures* (USACE, May 2007). The ratios were developed during an expert-opinion elicitation process conducted by the Sacramento District for use in the American River Economic Reevaluation Report (2008).

2.6 RISK AND UNCERTAINTY

Uncertainty is especially prevalent in the estimation of flood risk. A list of all the potential sources of uncertainty would be nearly endless. However, primary sources of uncertainty evaluated in this study include: (1) Levels of Storm Water Discharge; (2) River Stage; (3) Levee Performance; (4) Depreciated Structure and Structure Content Values; and (5) Flood Damages to Structures and Structure Contents. Risk and uncertainty in this analysis was accounted for in compliance with USACE guidance.[2] The section below describes these sources of uncertainty and how each is accounted for in this analysis.

LEVELS OF STORM WATER DISCHARGE – Uncertainty in the level of rainwater discharge associated with a storm event with a given probability of occurrence is driven by a number of inconsistent factors. Storms with equal probabilities of occurrence can differ in the amount of rainfall they produce at various locations throughout the watershed. They can also differ in their intensity, the time that elapses while rain is falling. Ground permeability, soil moisture, ambient temperature and other physical factors at the time of the storm also play an important role in determining when and where rainwater enters the river's channel. All of these natural factors lead to variability in the level of discharge found at a particular location along the river, following any given storm event.

RIVER STAGE – For a given level of discharge, there is uncertainty in the expected water surface elevations for specific locations within the channel. The shape of the riverbed, water temperature, location and amount of debris as well as other obstructions in the channel all add uncertainty to the estimated water surface elevations associated with storms of otherwise equal levels of discharge. To address this uncertainty, engineering data inputs were used to estimate standard deviations for various river stages. These estimated standard deviations are based on level of discharge and location in the floodplain.

LEVEE PERFORMANCE – Geotechnical fragility curves were used to quantify the probability of failure at each breach location for river stages below the top of levee. For each river stage, there is uncertainty in the ability of the levees and banks to contain flood flows without structural failure. The geotechnical fragility curves used to quantify levee performance for this study were developed with uncertainty surrounding under-seepage reliability, through-seepage reliability, long-term stability, and engineering judgment. However, the resulting fragility curves used to model flood damage do not include uncertainty of performance probabilities at the various river stages on the curve.

STRUCTURE ELEVATIONS – The susceptibility of a structure to damage depends on a number of uncertain variables. One key variable, the structure elevation, can be decomposed into two error prone estimates: topographic and first floor elevations. The level of uncertainty in structures' topographic elevations is a function of the accuracy of data used to derive ground elevations. For example, elevation estimates derived from examining a five-foot contour map are likely to contain more error, and therefore have higher levels of uncertainty, than estimates derived using a two-foot aerial survey contour map. The second source of uncertainty in elevation data is the result of error in first floor or foundation height estimates. Foundation height data is important since structures built on land mounds or those with large crawl spaces may sustain little or no damage during floods that inundate surrounding areas and nearby properties. First floor height data error varies according to the precision of the method used to measure foundation heights. In practice, these methods range from best-guess estimates to windshield and professional surveys.

[2] ER 1105-2-101

DEPRECIATED STRUCTURE AND CONTENT REPLACEMENT VALUES – The magnitude of damages to a particular structure following a given flood event is a function of its current, depreciated replacement value and the value of its contents. The current or depreciated value of a structure is uncertain for several reasons. First, per square foot structure values are calculated by estimating the construction type, quality and condition of structures during field surveys. These estimates are subject to human error associated with incorrectly classifying a structure within each category. The type, construction quality and condition classifications themselves may further induce error if they do not adequately account for the proper range of possible per square foot values.

FLOOD DAMAGES TO STRUCTURES AND STRUCTURE CONTENTS – Finally, there is considerable uncertainty in evaluating structure and content damages that would occur given a particular level of flooding. Damages to residential structures were evaluated using depth-damage functions and associated standard error estimates developed by the Institute for Water Resources (IWR). These depth-damage functions and standard error estimates are based upon the damages that actually occurred during previous flood events in the United States.

2.7 HEC-FDA SOFTWARE

The primary analytical tool used to perform the economic analysis was the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) software, version 1.2.5a. This program uses engineering and economic data to model flood risk with uncertainty and evaluate potential solutions in the study area.

2.8 PROJECT BENEFIT CALCULATION

Benefits for each alternative are based on the reduction in economic damages as compared to the future without-project condition.

The benefits of all alternatives are based on a 50-year period of analysis beginning the year that a federal project would likely be completed. It is possible that differing construction schedules will result in varying base years among the alternatives.

CHAPTER 3 — WITHOUT-PROJECT CONDITIONS ANALYSIS

3.1 CONSEQUENCE VARIABLES

Consequences in this study are defined as property damage, life-loss, and loss of critical infrastructure due to levee breach for a given annual chance exceedance (ACE) event. The variables that factor into consequence estimation are described in the following sections.

3.1.1 STRUCTURES AND CONTENTS

Structures were categorized by land use and classified as residential, commercial, industrial, or public. Structure counts by damage category and consequence area are shown in Table 3-1 below. The total base year value of structures, contents, and automobiles within the Lower San Joaquin study area is estimated at $28.7 billion. Total structure and content values are summarized by damage category and consequence area in Table 3-2.

TABLE 3-1: STRUCTURES IN THE 0.2% ACE FLOODPLAIN

CONSEQUENCE AREA	NUMBER OF STRUCTURES				
	COMMERCIAL	INDUSTRIAL	PUBLIC	RESIDENTIAL	TOTAL
NORTH STOCKTON	1,174	68	113	32,322	33,677
CENTRAL STOCKTON	1,585	605	360	30,843	33,393
RD 17	131	238	50	12,147	12,566
TOTAL	2,890	911	523	75,312	79,636

TABLE 3-2: VALUE OF DAMAGEABLE PROPERTY ($1,000S)

CONSEQUENCE AREA	STRUCTURE AND CONTENT VALUES					
	AUTOS	COMMERCIAL	INDUSTRIAL	PUBLIC	RESIDENTIAL	TOTAL
NORTH STOCKTON	414,000	2,154,000	115,000	359,000	8,856,000	11,898,000
CENTRAL STOCKTON	324,000	1,953,000	2,010,000	781,000	6,094,000	11,162,000
RD 17	120,000	291,000	1,944,000	111,000	3,172,000	5,638,000
TOTAL	858,000	4,398,000	4,069,000	1,251,000	18,122,000	28,698,000

3.1.2 DEPTH-PERCENT DAMAGE FUNCTIONS

Depth-percent damage functions represent the relationship between inundation depth at a structure and the percentage of damage caused by that depth. Economic damage is calculated as a percentage of damage

specified by the depth-percent damage function multiplied by the total value of structure and contents. Residential depth-damage curves (structures and contents) were taken from Economic Guidance Memorandum (EGM) 01-03, *Generic Depth-Damage Relationships*, and 04-01, *Generic Depth-Damage Relationships for Residential Structure with Basements*. Mobile home curves were taken from the May 1997 Final Report, *Depth Damage Relationships in Support of Morganza to the Gulf, Louisiana Feasibility Study*. Non-residential structure curves were based on revised Federal Emergency Management Agency (FEMA) Flood Insurance Administration (FIA) curves.

3.2 PROBABILITY VARIABLES

The overall likelihood that flooding will occur in a given year is dependent on the probabilities associated with the engineering inputs described in section 2.3. Please refer to the Hydrologic, Hydraulic, and Geotechnical appendices for further details about the probability variables used in the HEC-FDA models.

3.3 ANNUALIZED DAMAGES

Equivalent annual damages for the Lower San Joaquin study area are estimated to be approximately $383 million. Damages by consequence area and damage category are shown in Table 3-3 below.

TABLE 3-3: EQUIVALENT ANNUAL DAMAGES BY CONSEQUENCE AREA ($1,000S)

CONSEQUENCE AREA	DAMAGE CATEGORY					
	AUTOS	COMMERCIAL	INDUSTRIAL	PUBLIC	RESIDENTIAL	TOTAL
NORTH STOCKTON	16,000	48,000	2,000	10,000	183,000	259,000
CENTRAL STOCKTON	4,000	11,000	18,000	6,000	57,000	96,000
RD17	1,000	1,000	13,000	1,000	12,000	28,000
TOTAL	21,000	60,000	33,000	17,000	252,000	383,000

3.4 FUTURE WITHOUT-PROJECT CONDITION

3.4.1 REPETITIVE DAMAGES

The current certified HEC-FDA model assumes future inventory will not be impacted by flooding that may occur over the period of analysis. In other words, structures that sustain flood damage in a given analysis year are assumed to be fully restored to pre-flood condition prior the next analysis year. This assumption is not supported by empirical evidence, which shows that complete restoration of all structures is unlikely in areas subjected to catastrophic flooding. By assuming a complete and immediate rebuild of damaged structures, the HEC-FDA model overestimates future year damages in simulations where more than one flood occurs over the period of analysis.

Impact areas NS-02, NS-03, and CS-01 each contain breach locations where without-project AEP values suggest a high likelihood of multiple floods over the period of analysis. Therefore, future without-project inventory values were adjusted to account for structures that may be abandoned or not fully restored after a flood. In order to qualify for future value adjustment, a structure must sustain a minimum of 50% value loss from an event with an annual chance exceedance of 10% or greater. Once the qualifying structures

were identified for each impact area, future without-project inventory values were calculated using the following assumptions:

- Two floods will occur at index points D3, D4, D-BS, and D5 over the 50-year period of analysis.
- 80% of structures sustaining value loss of 50% or greater will be rebuilt or restored to pre-flood condition after each successive flood[3].
- Structures sustaining less than 50% damage are assumed to be fully restored

Table 3-4 summarizes future inventory values for damage areas impacted by repetitive damages.

TABLE 3-4: REPETITIVE DAMAGES—IMPACT ON FUTURE INVENTORY VALUE

DAMAGE AREA	INDEX POINT	EXPECTED RETURN PERIOD (YEARS)		TOTAL INVENTORY VALUE ($1,000s)		
		PRESENT YEAR	FUTURE YEAR	PRESENT YEAR	FUTURE YEAR	% DIFFERENCE
NS-02	D3	6.6	4.8	2,057,000	1,849,000	-10.1%
NS-03	D-BS	15.5	10.4	2,530,000	2,146,000	-15.2%
CS-01	D5	6.6	5.3	2,083,000	1,887,000	-9.4%

3.4.2 CLIMATE CHANGE

As discussed in Section 2.4.4, sea level rise due to climate change is expected to result in higher probabilities of flooding in the future at some index points. Table 3-5 compares annual exceedance probability for existing and future without-project conditions for index points that are expected to be affected by sea level rise. Index points CL2, CR2, and SL2 are not expected to be impacted by sea level rise and are not included in this table.

[3] Rebuilding/restoration assumptions are based on empirical data collected in New Orleans following Hurricane Katrina

TABLE 3-5: EXPECTED IMPACTS OF CLIMATE CHANGE

DAMAGE AREA	INDEX POINT	ANNUAL EXCEEDANCE PROBABILITY	
		PRESENT YEAR	FUTURE YEAR
NS-02	D3	0.1519	0.2091
NS-03	D4	0.0646	0.0962
	D-BS	0.1521	0.1890
CS-01	D5	0.1197	0.1582
	FR1-1	0.0228	0.0415
	FR1-2	0.0109	0.0352
CS-02	FR1-1	0.0228	0.0415
	FR1-2	0.0109	0.0352
RD17	FL1	0.0132	0.0202
	LR1	0.0126	0.0141
	LR2	0.0211	0.0257
	LR3	0.0095	0.0101
	LR4	0.0073	0.0075
	LRTB	0.0117	0.0075

CHAPTER 4 — ALTERNATIVE EVALUATION

4.1 INITIAL ARRAY OF ALTERNATIVES

An initial array of flood risk management alternative plans was developed, evaluated and compared to identify a plan that reasonably maximizes net benefits. This initial array of flood risk management alternative plans primarily consists of various upstream and downstream dry dam configurations, bypass alignments, setback levees, a ring levee, and channel modifications. Alternatives in the initial array were either screened out or retained based on parametric cost and benefit analysis.

The following alternatives were retained from the initial array. Refer to Chapter 3 of the main report for descriptions of alternatives that were screened out.

4.1.1 NO ACTION ALTERNATIVE

This alternative would have no federal action identified. It would be expected that the future without-project assumptions would be maintained. It is expected that current flood risk management structures would be maintained and existing flood risk would remain.

4.1.2 NORTH STOCKTON ALTERNATIVES

North Stockton-B: Delta Front North and South, and Calaveras River. This alternative addresses the delta and tidal portion of the Calaveras River as the flooding sources. The alternative includes a closure structure across Mosher Slough. The alternative covers a total 50,400 linear feet (9.545 miles) of levee.

North Stockton-F: Delta Front North and South, and Calaveras River. This alternative addresses the right bank of the Calaveras River and the delta front as flooding sources. This alternative includes closure structures across Mosher Slough and Fourteenmile Slough. This alternative covers a total 69,300 linear feet (13.125 miles) of levee.

4.1.3 CENTRAL STOCKTON ALTERNATIVES

Central Stockton-D: Calaveras River, Diverting Canal, and San Joaquin River. This alternative addresses the San Joaquin River, Stockton Diverting Canal, Calaveras River, French Camp Slough and Duck Creek as flooding sources and includes the Smith Canal closure structure. The alternative covers a total 88,900 linear feet (16.837 miles) of levee.

Central Stockton-F: Calaveras River and San Joaquin River. This alternative addresses the tidal portion of the Calaveras River, the San Joaquin River, French Camp Slough, and Duck Creek as flooding sources. The Smith Canal closure structure is also included. The alternative covers a total 51,600 linear feet (9.773 miles) of levee.

4.1.4 RECLAMATION DISTRICT 17 ALTERNATIVES

RD17-E: San Joaquin River North with Tieback and Extension. This alternative addresses the San Joaquin River and French Camp Slough as flooding sources. This alternative also extends the tie-back levee to address flanking issues. The alternative covers a total 106,900 linear feet (18.731 miles) of levee.

4.2 FOCUSED ARRAY OF ALTERNATIVES

The project delivery team (PDT) used measures retained from the initial array to develop a focused array of alternatives. Each alternative in the focused array was evaluated on its performance relative to planning criteria set forth in USACE guidance, which states that the plan most reasonably maximizing net economic benefits is identified as the National Economic Development (NED) plan. A plan other than the NED Plan may be selected based on additional criteria but would require approval by the Assistant Secretary of the Army for Civil Works (ASA[CW]).

The following alternatives were retained from the focused array. Refer to Chapter 3 of the main report for descriptions of alternatives that were screened out.

4.2.1 NO ACTION

This alternative would have no federal action identified. It would be expected that the future without-project assumptions would be maintained. It is expected that current flood risk management structures would be maintained and existing flood risk would remain.

4.2.2 ALTERNATIVE LS-7A

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-B and Central Stockton-F. The alternative would implement levee improvements without implementing either of the Mormon Channel or Paradise Cut bypasses. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. The proposed levee improvements in this alternative are comparable to Alternative 7b, with the exception that the RD17 components are not included.

4.2.3 ALTERNATIVE LS-7B

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-B, Central Stockton-F, and RD17-E. The alternative would implement levee improvements without implementing either of the Mormon Channel or Paradise Cut bypasses. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. There would also be approximately 2.2 miles of new levee constructed to extend the RD-17 tie-back levee and the secondary levee at the Old River flow split. The new levees would also include a cutoff wall to address potential seepage issues.

4.2.4 ALTERNATIVE LS-8A

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-F and Central Stockton-D. The alternative would implement levee improvements without implementing either of the Mormon Channel or Paradise Cut bypasses. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. The proposed levee improvements in this alternative are comparable to Alternative 8, with the exception that the RD17 components are not included.

4.2.5 ALTERNATIVE LS-8B

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-F, Central Stockton-D, and RD17-E. The alternative would implement levee improvements without implementing either of the Mormon Channel or Paradise Cut bypasses. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. There would also be approximately 2.2 miles of new levee constructed to extend the RD-17 tie-back levee and the secondary levee at the Old River flow split. The new levees would also include a cutoff wall to address potential seepage issues.

4.2.6 ALTERNATIVE LS-9A

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-B, Central Stockton-F, and the Mormon Channel Bypass. The alternative would implement levee improvements along with restoration of the Mormon Channel including a diversion control structure at the Stockton Diverting Canal. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. The diversion control structure for Mormon Channel at the Stockton Diverting Canal would consist of pipe culverts with gates to control releases to a maximum flow of approximately 1,200 cubic feet per second to Mormon Channel. The proposed levee improvements in this alternative are comparable to Alternative 9b, with the exception that the RD17 components are not included.

4.2.7 ALTERNATIVE LS-9B

This alternative combines the following alternatives to arrive at a comprehensive solution: North Stockton-B, Central Stockton-F, RD17-E, and the Mormon Channel Bypass. The alternative would implement levee improvements along with restoration of the Mormon Channel including a diversion control structure at the Stockton Diverting Canal. The alternative would combine the levee improvement measures of cutoff wall, deep soil mixing (seismic), seepage berm, and levee geometry improvements. In addition to the levee improvements, this alternative would address projected sea level change by including raises in levee height where needed. There would also be approximately 2.2 miles of new levee constructed to extend the RD-17 tie-back levee and the secondary levee at the Old River flow split. The new levees would also include a cutoff wall to address potential seepage issues. The diversion control structure for Mormon Channel at the Stockton Diverting Canal would consist of pipe culverts with gates to control releases to a maximum flow of approximately 1,200 cubic feet per second to Mormon Channel.

4.3 WITH-PROJECT DAMAGES

The residual damages and project benefits for each final alternative are summarized in Table 4-1. Note that Table 4-1 contains unindexed damages and benefits. The values shown are the same as they were presented at the time the final array of alternatives was evaluated.

TABLE 4-1: FINAL ARRAY OF ALTERNATIVES—RESIDUAL DAMAGES ($1,000S)

ALTERNATIVE	RESIDUAL ANNUAL DAMAGES				ANNUAL BENEFITS*	ANNUAL DAMAGE REDUCTION
	NORTH STOCKTON	CENTRAL STOCKTON	RD-17	TOTAL		
NO ACTION	244,000	92,000	26,000	362,000	0	-
LS-7a	12,000	25,000	26,000	63,000	299,000	82.6%
LS-8a	2,000	20,000	26,000	48,000	314,000	86.7%
LS-9a	8,000	23,000	26,000	57,000	305,000	84.3%
LS-7b	14,000	21,000	2,000	37,000	325,000	89.8%
LS-8b	1,000	16,000	2,000	19,000	343,000	94.8%
LS-9b	7,000	20,000	2,000	29,000	333,000	92.0%

* Does not include benefits during construction

4.3.1 PROJECT COSTS

Project costs were estimated by USACE cost engineers. Total first cost and construction duration for each alternative are shown in Tables 4-2 through 4-7 below. These estimates do not include interest during construction.

TABLE 4-2: FIRST COST ESTIMATE—ALTERNATIVE LS-7A

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000S)
NORTH STOCKTON	2018	2028	$616,800
CENTRAL STOCKTON	2017	2020	$210,500
RD17	N/A	N/A	$0

TABLE 4-3: FIRST COST ESTIMATE—ALTERNATIVE 8A

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000S)
NORTH STOCKTON	2018	2028	$669,400
CENTRAL STOCKTON	2017	2020	$291,500
RD17	N/A	N/A	$0

TABLE 4-4: FIRST COST ESTIMATE—ALTERNATIVE 9A

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000S)
NORTH STOCKTON	2018	2028	$607,200
CENTRAL STOCKTON	2017	2020	$248,300
RD17	N/A	N/A	$0

TABLE 4-5: FIRST COST ESTIMATE—ALTERNATIVE 7B

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000s)
NORTH STOCKTON	2018	2028	$599,700
CENTRAL STOCKTON	2017	2020	$204,000
RD17	2024	2030	$410,100

TABLE 4-6: FIRST COST ESTIMATE—ALTERNATIVE 8B

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000s)
NORTH STOCKTON	2018	2028	$644,000
CENTRAL STOCKTON	2017	2020	$280,000
RD17	2024	2030	$410,000

TABLE 4-7: FIRST COST ESTIMATE—ALTERNATIVE 9B

FIX	START YEAR	END YEAR	TOTAL FIRST COST ($1,000s)
NORTH STOCKTON	2018	2028	$594,000
CENTRAL STOCKTON	2017	2020	$242,000
RD17	2024	2030	$406,000

4.3.2 INTEREST AND BENEFITS DURING CONSTRUCTION

As delivered, the total project costs did not include interest during construction or benefits during construction.

Interest during construction (IDC) accrues each year between the start of construction and the base year. Total IDC is annualized over the period of analysis and added to the annual project cost.

Benefits during construction (BDC) are benefits that accrue annually between the year that one or more elements of the project begin to realize benefits and the base year. Total BDC is annualized over the period of analysis and added to the annual project benefits.

IDC and BDC were calculated using the Institute for Water Resources (IWR) Planning Suite software using the FY2018 discount rate of 2.75% and a 50 year period of analysis. IDC and BDC for each alternative is shown in Table 4-8.

TABLE 4-8: INTEREST AND BENEFITS DURING CONSTRUCTION ($1,000S)

	INTEREST DURING CONSTRUCTION		BENEFITS DURING CONSTRUCTION	
ALTERNATIVE	Total	Annual	Total	Annual
NO ACTION	$0	$0	$0	$0
LS-7a	$185,000	$7,000	$616,000	$25,000
LS-8a	$224,000	$9,000	$662,000	$26,000
LS-9a	$196,000	$8,000	$631,000	$25,000
LS-7b	$288,000	$11,000	$1,317,000	$52,000
LS-8b	$337,000	$13,000	$1,403,000	$56,000
LS-9b	$301,000	$12,000	$1,350,000	$54,000

4.4 NET BENEFITS AND BENEFIT-TO-COST RATIO

Once benefit and cost calculations are complete, each alternative can be evaluated based on its net benefits (total return on investment) and benefit-to-cost ratio (return on each dollar invested). These metrics may provide the basis for decision-makers when selecting a plan. The net benefits and benefit-to-cost ratios for each final alternative are reported in Table 4-9. Note that Table 4-9 contains unindexed damages, costs, and benefits. The values shown are the same as they were presented at the time the final array of alternatives was evaluated.

TABLE 4-9: FINAL ARRAY OF ALTERNATIVES—ECONOMIC SUMMARY

ALTERNATIVE	RESIDUAL DAMAGES ($1,000s)	ANNUAL BENEFITS* ($1,000s)	ANNUAL COST† ($1,000s)	NET BENEFITS ($1,000s)	BENEFIT TO COST RATIO
NO ACTION	362,000	0	0	0	0.0
LS-7a	65,000	322,000	39,000	283,000	8.26
LS-8a	48,000	340,000	46,000	294,000	7.39
LS-9a	57,000	330,000	41,000	289,000	8.05
LS-7b	37,000	378,000	59,000	319,000	6.41
LS-8b	19,000	399,000	66,000	333,000	6.05
LS-9b	29,000	387,000	60,000	327,000	6.45

* Includes benefits during construction

† Includes interest during construction

4.5 REFINEMENTS TO THE RECOMMENDED PLAN

Alternative LS-7a was identified as the Recommended Plan. USACE cost engineers conducted a detailed analysis to estimate the cost and schedule of constructing the plan. Final cost estimates were reviewed and certified by the USACE Walla Walla District Cost Engineering Mandatory Center of Expertise.

The certified cost estimates for the Recommended Plan are summarized in Table 4-10. Detailed interest during construction calculations are shown in tables 4-11 and 4-12. Detailed benefits during construction calculations are shown in Table 4-13. A summary of the refined economic benefit/cost analysis for the Recommended Plan is provided in Table 4-14.

TABLE 4-10: RECOMMENDED PLAN—REFINED COST ESTIMATE – VALUES IN $1,000S

FIX	FIRST COST	IDC†	TOTAL ECONOMIC COST	OMRR&R	ANNUAL COST‡
NORTH STOCKTON	684,234	180,629	864,863	596	32,631
CENTRAL STOCKTON	386,075	51,200	437,275	466	16,663
RD17	0	0	0	0	0
TOTAL	1,070,309	231,829	1,302,138	1,062	49,294

† Interest calculated using FY2018 discount rate of 2.75%

‡ Includes annual OMRR&R cost of $1.06 million

TABLE 4-11: RECOMMENDED PLAN—INTEREST DURING CONSTRUCTION†—NORTH STOCKTON VALUES IN $1,000S

YEAR	PRESENT WORTH FACTOR	COSTS PRIOR TO BASE	PRESENT VALUE OF COSTS	INTEREST
2021	1.442297	$62,203	$89,715	$27,513
2022	1.403695	$62,203	$87,314	$25,111
2023	1.366127	$62,203	$84,977	$22,774
2024	1.329564	$62,203	$82,703	$20,500
2025	1.293979	$62,203	$80,490	$18,286
2026	1.259347	$62,203	$78,335	$16,132
2027	1.225642	$62,203	$76,239	$14,036
2028	1.192839	$62,203	$74,198	$11,995
2029	1.160914	$62,203	$72,212	$10,009
2030	1.129843	$62,203	$70,280	$8,077
2031	1.099604	$62,203	$68,399	$6,196
2032	1.070174	$0	$0	$0
2033	1.041532	$0	$0	$0
2034	1.013657	$0	$0	$0
TOTAL		$684,233	$864,862	$180,629

† Interest calculated using FY2018 discount rate of 2.75%

TABLE 4-12: RECOMMENDED PLAN—INTEREST DURING CONSTRUCTION†—CENTRAL STOCKTON VALUES IN $1,000S

YEAR	PRESENT WORTH FACTOR	COSTS PRIOR TO BASE	PRESENT VALUE OF COSTS	INTEREST
2026	1.259347	$42,897	$54,023	$11,125
2027	1.225642	$42,897	$52,577	$9,679
2028	1.192839	$42,897	$51,169	$8,272
2029	1.160914	$42,897	$49,800	$6,903
2030	1.129843	$42,897	$48,467	$5,570
2031	1.099604	$42,897	$47,170	$4,273
2032	1.070174	$42,897	$45,908	$3,010
2033	1.041532	$42,897	$44,679	$1,782
2034	1.013657	$42,897	$43,483	$586
TOTAL		$386,073	$437,276	$51,200

† Interest calculated using FY2018 discount rate of 2.75%

TABLE 4-13: RECOMMENDED PLAN—BENEFITS DURING CONSTRUCTION‡
VALUES IN $1,000S

YEAR	PRESENT WORTH FACTOR	BENEFITS PRIOR TO BASE	PRESENT VALUE OF BENEFITS
2017-2031	-	$0	$0
2032	1.084790	$245,469	$266,283
2033	1.055756	$245,469	$259,156
2034	1.027500	$245,469	$252,220
2035	1.000000	$0	$0
TOTAL		$736,407	$777,659

TABLE 4-14: RECOMMENDED PLAN—ECONOMIC SUMMARY
MONETARY VALUES IN $1,000S

ANNUAL BENEFITS*	ANNUAL COSTS	NET BENEFITS	BENEFIT TO COST RATIO
345,024	49,294	295,730	7.0

* Includes benefits during construction

4.5.1 IMPACTS OF CLIMATE CHANGE ON THE RECOMMENDED PLAN

The consideration of sea-level rise analysis resulted in the identification of a higher performing NED plan than had sea-level rise not be considered.

The Recommended Plan is also no regrets plan in terms of the potential impacts of sea-level rise. Sea-level rise is expected to impact all alternatives equally, as each alternative in the final array includes identical fixes for the index points affected by sea-level rise.

4.5.2 SENSITIVITY TO SEA-LEVEL RISE

The impacts of sea-level rise were estimated by running HEC-FDA with discharge-stage functions adjusted for the future year condition using intermediate stage increase estimates over the period of analysis.

The sensitivity of the Recommended Plan's economic outputs were assessed by running HEC-FDA with discharge-stage functions adjusted using low and high sea-level rise estimates. Results showed the range of net benefits between the low and high curve to be roughly $62 million.

The Recommended Plan is believed to include measures that offer robust performance into the future across the range of potential climate change outcomes.

ATTACHMENT 1: OTHER SOCIAL EFFECTS

OTHER SOCIAL EFFECTS

The objective of the Other Social Effects (OSE) assessment is to provide a portrait of the social landscape of the Lower San Joaquin Feasibility Study area and offer a glimpse into the potential vulnerability of the people who live there. Table OSE-1Table OSE-1: Elements of OSE Analysis below summarizes the elements commonly included in the OSE account and the metrics used to evaluate them.

TABLE OSE-1: ELEMENTS OF OSE ANALYSIS

SOCIAL ELEMENT	METRICS
Social connectedness	Gender, race, ethnicity, age, rural versus urban communities, rental versus owner-occupied dwellings, and occupation
Community social capital	Education, family structure, rural vs. urban communities, and population growth
Community resilience	Income, political power, neighborhood prestige, employment loss, residential property characteristics, infrastructure and lifelines, family structure, and medical services
Life safety risk	Calculated as a function of the annual probabilities of various flood events and the associated life safety consequences

This assessment compares the other social effects associated with the without-project and with-project conditions. The 1% annual chance exceedance (ACE) floodplain serves as the baseline to assess effects.

CURRENT SOCIAL LANDSCAPE

Describing the social landscape of the area provides an understanding of who lives in the study area, who has a stake in the problem or issue, and why it is important to them. A demographic profile of the area is performed using social statistics, and the information is presented in a meaningful way through the use of comparisons and rankings. It is important to note that the profile itself is not an OSE analysis but rather a data collection step that provides a basic level of understanding about the social conditions in the area; the data provides input into a more in-depth analysis that targets areas of special concern or relevance to the water resources issue at hand. The basic social statistics of the study area are summarized in Table OSE-2 below. These statistics, along with the social elements listed in Table OSE-1, are indicators used to portray basic information about the social life and the processes of the study area.

TABLE OSE-2: BASIC SOCIAL CHARACTERISTICS OF THE STUDY AREA

SOCIAL STATISTIC	STOCKTON			CALIFORNIA		
	2000	2010	% Δ	2000	2010	% Δ
Population						
Total	243,771	291,707	19.7%	33,871,648	37,253,956	10%
Age						
Median	29.8	30.8	3.4%	33.3	35.2	5.70%
% >65	10.20%	10.00%	-2.0%	10.60%	11.40%	7.50%
% <18	32.40%	29.90%	-7.7%	27.30%	25.00%	-8.40%
Race & Ethnicity						
Asian	19.90%	21.50%	8.0%	10.90%	12.80%	17.40%
Black	11.20%	12.20%	8.9%	6.70%	5.80%	-13.40%
Hispanic	32.50%	40.30%	24.0%	32.40%	37.60%	16%
White	32.20%	22.90%	-28.9%	46.70%	40.10%	-14.10%
Other	4.20%	3.10%	-26.2%	4.30%	3.70%	86%
Education						
% HS Graduates	68.2%	73.70%	8.1%	81%	80.80%	-0.20%
% College Graduates	15.4%	17.50%	13.6%	30.50%	30.20%	-0.90%
Income and Poverty						
% Unemployed	7.3%	10.50%	43.8%	4.30%	7.10%	65.00%
Median Household Income	35,453	$47,246	33.3%	61,400	61,632	0.00%
% Below Poverty	38.4%	23.30%	-39.3%	15.30%	14.40%	-5.90%
Housing						
% Own	51.60%	51.90%	0.6%	56%	55.90%	0%
% Rent	48.40%	48.10%	-0.6%	44%	44.10%	0%
Quality of Life						
Avg. Household Size	3.04	3.17	4.3%	2.98	3.45	16%
Language Other than English Spoken at Home	41.5%	45.1%	8.7%	43.50%	43.20%	-0.70%
Mean Travel Time to Work (minutes)	27.2	26.4	-2.9%	27.1	27	-0.40%

Source: US Census Bureau

SOCIAL EFFECTS ASSESSMENT

A social effects assessment considers the social vulnerability and resiliency of a population. Social vulnerability refers to the sensitivity of a population to natural hazards, whereas social resiliency refers to the population's ability to respond to and recover from the impacts of a natural hazard. The characteristics that are recognized as having an influence on social vulnerability and resiliency generally include age, gender, race, and socioeconomic status as well as population segments with special needs or those without the normal social safety nets typically necessary to recover from a disaster. The quality of human settlements (*e.g.*, housing type and construction, infrastructure, and lifelines) and the built environment also play an important role in assessing social vulnerability and resiliency, especially as these characteristics influence potential economic losses, injuries, and fatalities from natural hazards. Tables OSE-3 and OSE-4 provide a discussion of factors that may influence social vulnerability and resiliency and also provides a qualitative assessment of the Lower San Joaquin River Feasibility study area based on indicator statistics from the 2010 U.S. Census. The discussion column is from the article, *Social Vulnerability to Environmental Hazards*, which was published in the June 2003 edition of Social Science Quarterly.

TABLE OSE-3: SOCIAL VULNERABILITY AND RESILIENCY FACTORS

INDICATOR	DISCUSSION	ASSESSMENT
Income, Political Power, and Prestige	This measure focuses on the ability to absorb losses and enhance resilience to hazard impacts. Wealth enables communities to absorb and recover from losses more quickly due to insurance, social safety nets, and entitlement programs.	The median household income of the area is 30% less than the median for the state of California; however, the city's proximity to the state's Capital of Sacramento may provide significant access to political resources.
Gender	Women can have a more difficult time during recovery than men, often due to sector-specific employment, lower wages, and family care responsibilities.	Women make up 46.0% of the work force while men make up 54.0%; the median income for women in the area is $42,824, which is 89% of the median income for men.
Race and Ethnicity	Race and ethnicity may impose language and cultural barriers that affect access to post-disaster funding	The area is highly diverse in terms of race and ethnicity. Over 40% of the residents speak a language other than English at home; this may contribute to the vulnerability and possibly the resiliency of the community.
Age	Extremes on the age spectrum inhibit the movement out of harm's way. Parents lose time and money caring for children when daycare facilities are affected; the elderly may have mobility constraints or mobility concerns increasing the burden of care and lack of resilience.	Those age 65 and over make up a slightly lower percentage of the community's population as compared to the percentage for the same age category for the state as a whole; the percentage of residents younger than 18 (29.9%) is slightly higher than the state statistic (25%).
Employment Loss	The potential loss of employment following a disaster exacerbates the number of unemployed workers in a community, contributing to a slower recovery from the disaster.	The latest Census indicates that the current unemployment rate in the area may be significantly higher than the state's. A flood event which causes additional unemployment may exacerbate the current unemployment rate.
Rural/Urban	Rural residents may be more vulnerable due to lower incomes, and may be more dependent on locally-based resource extraction economies (farming and fishing). High-density areas (urban) complicate evacuation from harm's way.	The area is highly urbanized and close to many resources.
Residential Property	The value, quality, and density of residential construction affect potential losses and recovery. For example, expensive homes are costly to replace, while mobile homes are easily destroyed and less resilient to hazards.	The area is comprised of a full spectrum of homes – from average quality to excellent. Medium density neighborhoods are typical, with higher density neighborhoods in the downtown area.
Infrastructure and Lifelines	Loss of sewers, bridges, water, communications, and transportation infrastructure may place an insurmountable financial burden on the smaller communities that lack the financial resources to rebuild.	Many of the neighborhoods within the study area are well-established and would most likely have access to the many resources available within the city itself as well as within the greater Sacramento area to the north.

TABLE OSE-4: SOCIAL VULNERABILITY RESILIENCY FACTORS (CONTINUED)

INDICATOR	DISCUSSION	ASSESSMENT
Renters	People that rent typically do so because they are either transient or do not have the financial resources for home ownership. They often lack access to information about financial aid during recovery. In the most extreme cases, renters lack sufficient shelter options when lodging becomes uninhabitable or too costly to afford.	The number of rentals in the area is significant (about 48%), and is higher than the state average of about 44%. The high rental population may contribute to communication cohesion issues; research indicates that renters do not have the same level of community pride as owners do, which may lead to more challenges in redeveloping a community after a flood event.
Occupation	Some occupations, especially those of resource extraction, may be severely impacted by a hazard event. Self-employed fishermen suffer when their means of production is lost and may not have the requisite capital to resume work in a timely fashion and thus will seek alternative employment. Migrant workers engaged in agriculture and low skilled service jobs (e.g., housekeeping, childcare, and gardening) may similarly suffer, as disposable income fades and the need for services decline. Immigration status also affects occupational recovery.	The number of people that live in the area and work in resource extraction occupations is fairly low; the 2010 Census indicates that around 4,329 people (or 3.2% of the total work force) work in the farming, fishing, and forestry occupations.
Family Structure	Families with large numbers of dependents or single-parent households often have limited finances to outsource care for dependents, and thus must juggle work responsibilities and care for family members. All affect the resilience to recover from hazards.	The literature indicates that families having greater than four persons have more financial difficulty than smaller families. Accordingly, community planners need to be aware of issues that may arise.
Education	Education is strongly linked to socioeconomic status, with higher educational attainment resulting in greater lifetime earnings. Lower education constrains the ability to understand warning information and access to recovery information.	Nearly 74% of the population has graduated from high school and 17.5% hold a bachelor's degree.
Population Growth	Counties experiencing rapid growth lack available quality housing; its social services network may not have had time to adjust to increased populations. New migrants may not speak the language and not be familiar with bureaucracies for obtaining relief or recovery information, all of which increases vulnerability.	Stockton has grown considerably over the past 10-15 years. The population has grown by about 20%--nearly double the state's population growth rate. Rapid growth is highly correlated with low community cohesion. The sense of belonging, cooperation, and community pride are dynamic factors which help with community resilience but which may not be as strong in cities that have experienced rapid growth.
Medical Services	Health care providers, including physicians, nursing homes, and hospitals are important post-event sources of relief. The lack of proximate medical services will lengthen immediate relief and result in longer recovery from disasters.	The residents of Stockton would have access to medical facilities in nearby areas, which include the greater Sacramento metropolitan area approximately 45 miles to the north.

LIFE SAFETY EVALUATION

A life safety evaluation was conducted for both the No Action alternative and Alternative LS-7a. Life safety was evaluated based on the following variables: (1) the probability of an annual chance exceedance (ACE) event occurring; (2) the probability of levee failure given the occurrence of an ACE event; (3) the depth of flooding that would occur following a levee failure; and (4) the population density in the flooded area.

Life safety risk was evaluated in two parts. First, a risk matrix was developed based on flood probabilities and inundation depths. Probabilities range from the highly improbable to the very likely, while flood depths range from very shallow to catastrophically deep. The risk matrix and associated qualitative risk factors are shown in Figure OSE-1 below.

FIGURE OSE-1: FLOOD RISK MATRIX

-RISK-		DEPTH (FT)				
		0-2	2-5	5-10	10-15	15-20
PROBABILITY	1:10,000	VERY LOW	VERY LOW	VERY LOW	VERY LOW	LOW
	1:1,000	VERY LOW	VERY LOW	LOW	LOW	LOW
	1:500	VERY LOW	LOW	LOW	LOW	MEDIUM
	1:250	VERY LOW	LOW	LOW	MEDIUM	HIGH
	1:100	VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
	1:25	LOW	MEDIUM	HIGH	VERY HIGH	VERY HIGH
	1:10	LOW	HIGH	VERY HIGH	VERY HIGH	VERY HIGH

The tables and figures below are provided to compare flood risk to the population of the LSJRFS study area for the Recommended Plan. Tables OSE-5 and OSE-6 list the number of people in each risk category for the existing and future condition. The maps in figures OSE-2 and OSE-3 show existing and future flood risk based on the probability and depth of flooding.

TABLE OSE-5: POPULATION BY FLOOD RISK CATEGORY—EXISTING CONDITION

FLOOD RISK	ALTERNATIVE	
	NO ACTION	LS-7A
Very Low	77,192	87,594
Low	80,214	121,202
Medium	61,798	16,628
High	8,230	2,030
Very High	21	0

TABLE OSE-6: POPULATION BY FLOOD RISK CATEGORY—FUTURE CONDITION

FLOOD RISK	ALTERNATIVE	
	NO ACTION	LS-7a
Very Low	77,192	80,982
Low	78,565	127,815
Medium	62,714	16,628
High	8,946	2,030
Very High	38	0

FIGURE OSE-2: FLOOD RISK—ALTERNATIVE LS-7A—EXISTING CONDITION

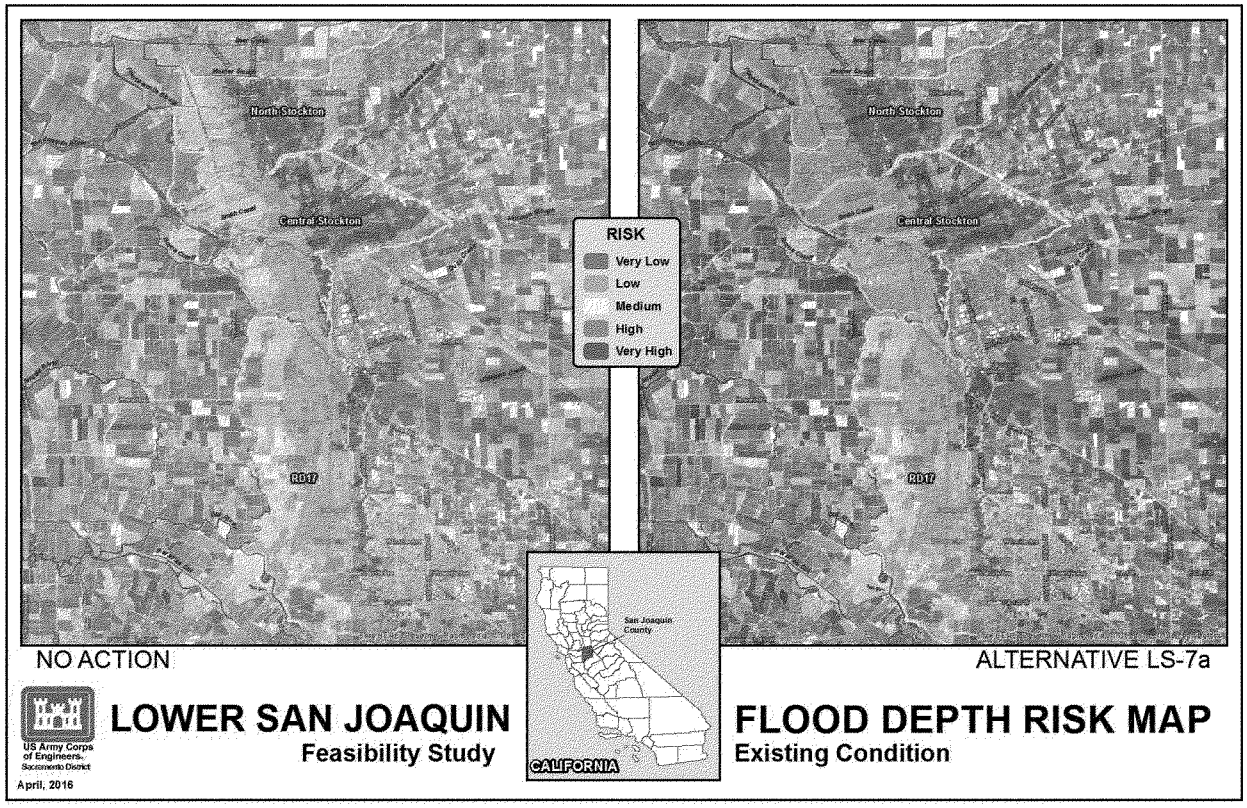
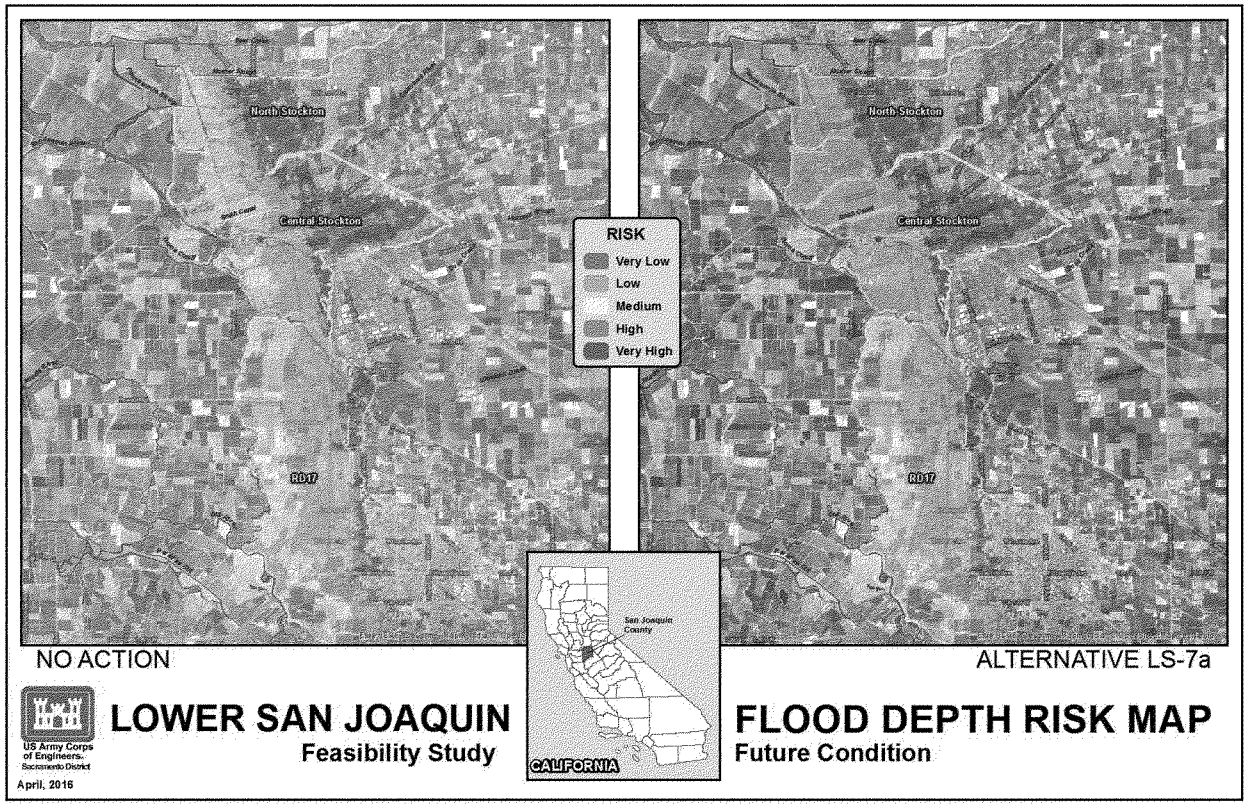


FIGURE OSE-3: FLOOD RISK— ALTERNATIVE LS-7A FUTURE CONDITION



The second part of the life safety evaluation was to adjust the flood risk factors up or down based on population density in the affected area. The population density metric was selected because it represents the severity of consequences in the risk equation. In other words, the more people living in a flooded area, the higher the life safety risk, all else being equal. Conversely, the fewer people living in a flooded area, the lower the life safety risk, all else being equal.

According to the US Census Bureau, the average metropolitan statistical area (MSA) has a population density of roughly 4,400 people per square mile[1]. The population density of the LSJRFS study area is reasonably close to that estimate with an average of 4,126 people per square mile.

The risk matrix on page xxxv is designed to describe flood risk in an area of average population density. For life safety risk estimation purposes, portions of the study area with a population density within one standard deviation below or two standard deviations above the mean population density were deemed average. Flood risk was assessed for these areas using the risk factors as shown in the matrix.

For areas more than two standard deviations above the mean, the risk factor was increased by one increment (medium becomes high, high becomes very high, etc.) For areas more than one standard deviation below the mean[2], the risk factor was reduced by one increment (medium becomes low, low becomes very low, etc.) Risk factors were not adjusted below very low or above very high.

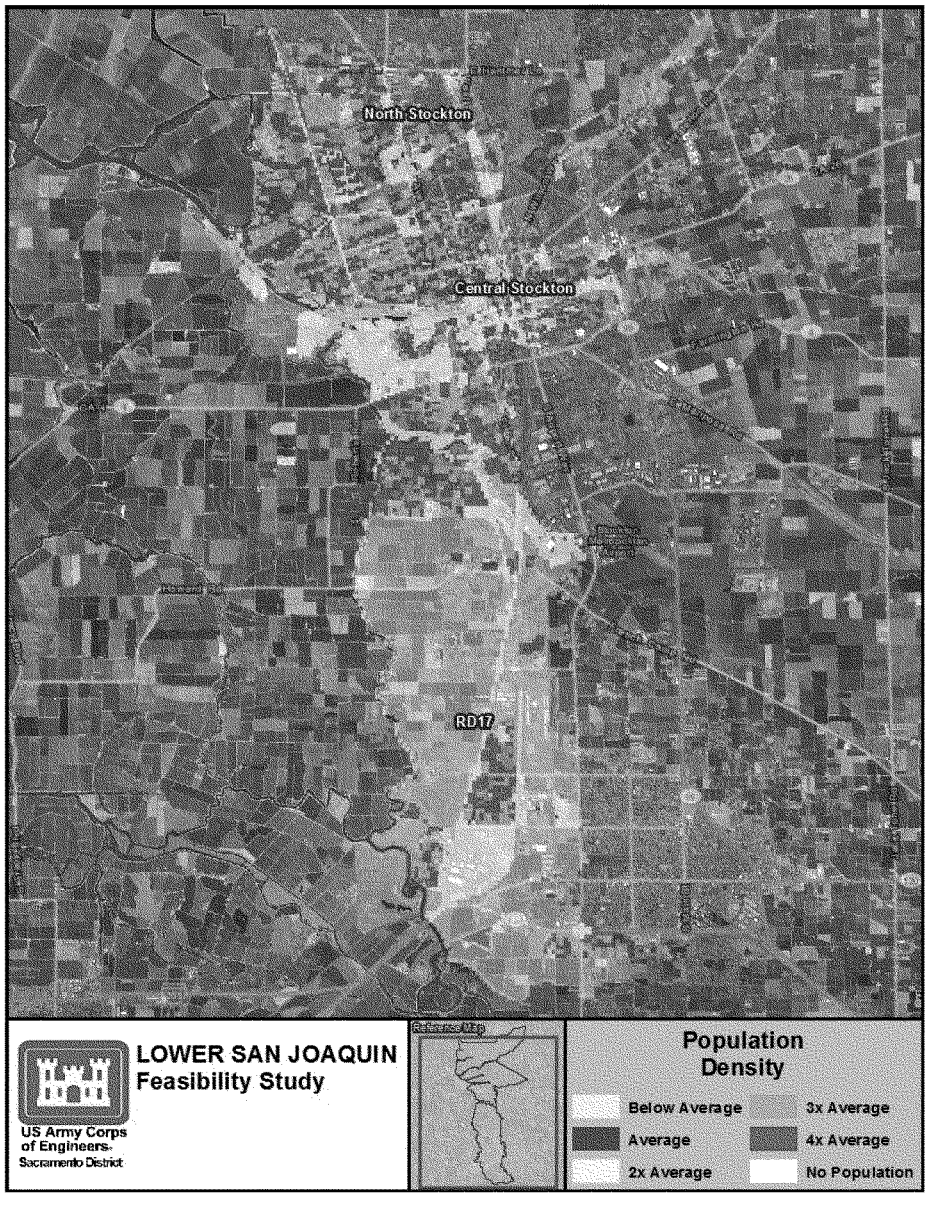
Table OSE-7 summarizes the risk adjustment factors and the total population affected by each factor adjustment. The map in Figure OSE-4 provides graphic representation of the population density classifications shown in Table OSE-7.

TABLE OSE-7: RISK ADJUSTMENT BY DEVIATION FROM NATIONAL MEAN POPULATION DENSITY

POPULATION DENSITY DEVIATIONS FROM MEAN	RISK FACTOR ADJUSTMENT	POPULATION IMPACTED
More than 1 below	-1	8,978
1 below to 1 above	0	37,053
1 above to 2 above	0	62,547
2 above to 3 above	+1	45,618
More than 3 above	+1	73,258

[1] Data is from the report Distance Profiles for U.S. Metropolitan Statistical Areas: 2000 and 2010 (US Census Bureau).
[2] Zero is 1.05 standard deviations below the mean. Therefore one standard deviation below the mean was deemed an appropriate threshold to define areas of low population density.

FIGURE OSE-4: POPULATION DENSITY MAP—STUDY AREA



In this analysis, flood risk adjusted for population density will be referred as life safety risk. The tables and figures below compare life safety risk for the Recommended Plan. Tables OSE-5 and OSE-6 list the number of people in each risk category for the existing and future condition. The maps in figures OSE-7 and OSE-8 show existing and future life safety risk.

TABLE OSE-5: POPULATION BY LIFE SAFETY RISK CATEGORY—EXISTING CONDITION

FLOOD RISK	ALTERNATIVE	
	NO ACTION	LS-7A
Very Low	41,845	48,427
Low	84,256	118,501
Medium	71,939	50,720
High	27,757	9,165
Very High	1,658	643

TABLE OSE-6: POPULATION BY LIFE SAFETY RISK CATEGORY—FUTURE CONDITION

FLOOD RISK	ALTERNATIVE	
	NO ACTION	LS-7A
Very Low	41,845	44,039
Low	82,913	120,667
Medium	72,287	52,942
High	28,693	9,165
Very High	1,718	643

FIGURE OSE-7: LIFE SAFETY RISK— ALTERNATIVE LS-7A —EXISTING CONDITION

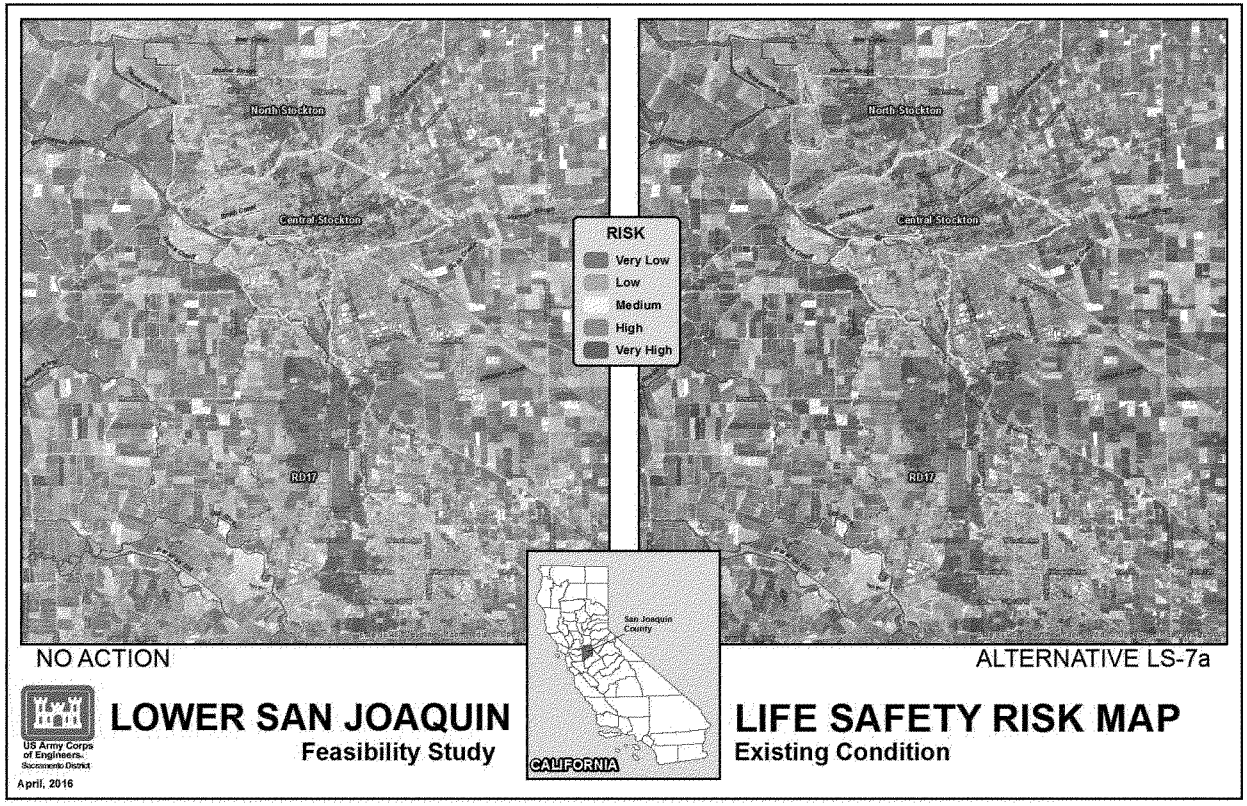
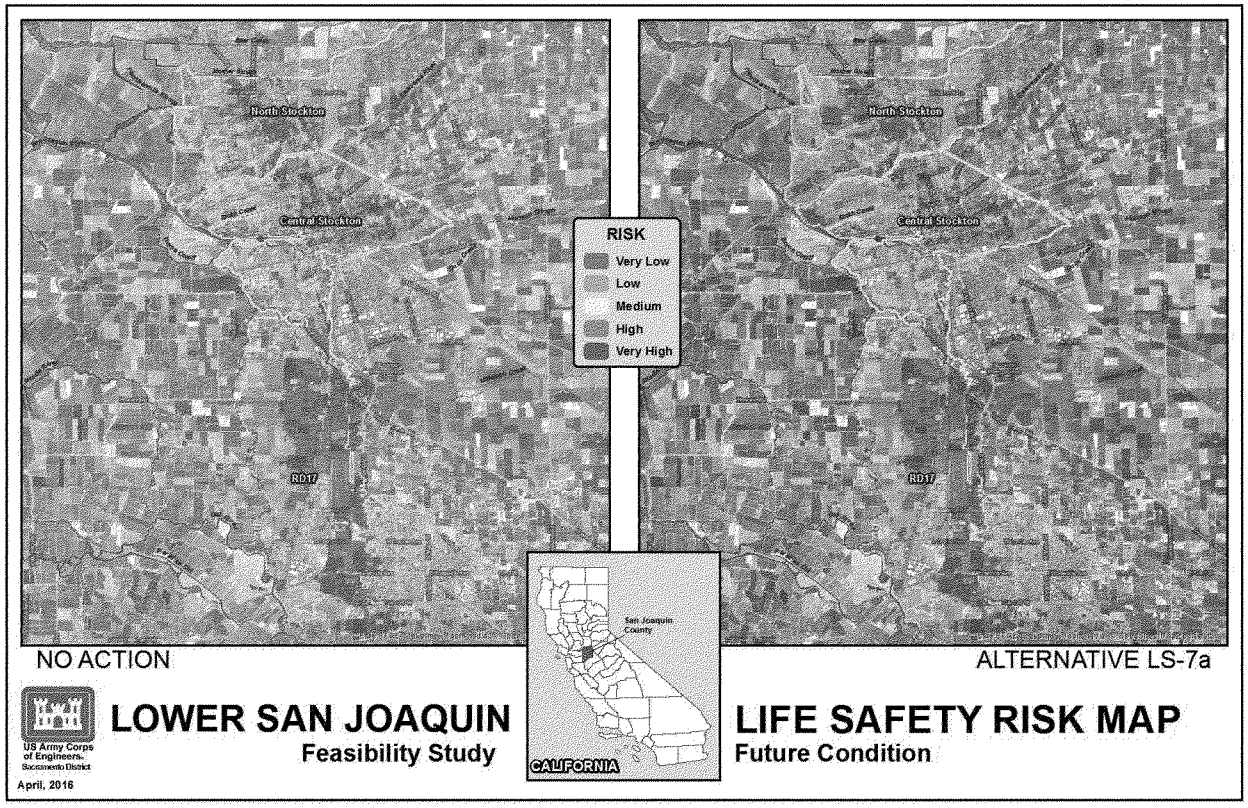


FIGURE OSE-8: LIFE SAFETY RISK— ALTERNATIVE LS-7A —FUTURE CONDITION



ATTACHMENT 2: REGIONAL ECONOMIC DEVELOPMENT

REGIONAL ECONOMIC DEVELOPMENT

PURPOSE AND METHODOLOGY

The U.S. Army Corps of Engineers (USACE) Planning Guidance Notebook (ER 1105-2-100) states that while the National Economic Development (NED) and Environmental Quality (EQ) accounts are required, display of the Regional Economic Development (RED) effects are discretionary. The Corps' NED procedures manual affirms that RED benefits are real and legitimate; however, the concern (from a Federal perspective) is that they are often offset by RED costs in other regions. Nevertheless, for the local community these benefits are important and can help them in making their preferred planning decisions.

Although the RED account is often examined in less detail than NED, it remains useful. For example, Hurricane Katrina caused a significant economic hardship to not just the immediate Gulf Coast but for entire counties, watersheds, and the state of Louisiana. Besides the devastating damage to homes (which are often captured by the NED account), hundreds of thousands of people lost their jobs, property values fell, and tourism and tax revenues declined significantly and were transferred to other parts of the U.S. In this example, the RED account can provide a better depiction of the overall impact to the region.

The distinction between NED and RED is a matter of perspective, not economics. A non-federal partner may consider the impacts at the state, regional, and local levels to be a true measure of a project's impact or benefit, whereas from the Corps' perspective, this may not constitute a national benefit. Gains in RED to one region may be partially or wholly offset by losses elsewhere in the nation. For example, if a Federal project enables a firm to leave one state to relocate to a newly-protected floodplain of another state, the increase in regional income for the project area may come at the expense of the former area's loss. In this case, there is no net increase in the value of the nation's output of goods and services and should be excluded from NED computations.

The following sections describe the impacts of the final array of alternatives from a regional perspective. The impacts were evaluated using the Corps' certified Regional Economic System (RECONS) software.

KEY RED CONCEPTS

Econometric analysis allows for the evaluation of a full range of economic impacts related to specific economic activities by calculating effects of the activities in a specific geographic area. These effects are:

- Direct effects, which consist of economic activity contained exclusively within the designated sector. This includes all expenditures made by the companies or organizations in the industry and all employees who work directly for them.
- Indirect effects, which define the creation of additional economic activity that results from linked business, suppliers of goods and services, and provisions of operating inputs.
- Induced effects, which measure the consumption expenditures of direct and indirect sector employees.

Input-output (I/O) models are characterized by their ability to evaluate the effects of industries on each other. Unlike most typical measures of economic activity that examine only the total output of an industry or the final consumption demand provided by a given output, I/O models provide a much more comprehensive view of the interrelated economic impacts. I/O analysis is based on the notion that there is a fundamental relationship between the volume of output of an industry and the volume of the various inputs used to produce that output. Industries are often grouped into production, distribution, transportation,

and consumption categories. Additionally, the I/O model can be used to quantify the multiplier effect, which refers to the idea that an increase in spending can lead to an even greater increase in income and consumption, as monies circulate (or multiply) throughout the economy.

FLOOD RISK MANAGEMENT RED CONSIDERATIONS

There are particular effects for each type of project improvement as they relate to the RED account. The estimation of RED flood-related effects can be very complex. At a minimum, the RED analysis should include a qualitative description of the types of businesses at risk from flooding, particularly those that could have a significant adverse impact (output, employment, etc.) upon the community or regional economies if their operations should be disrupted by flooding and how this would be affected by the recommended project. The potential RED effects to flood risk management projects are summarized in Table RED-1 below.

TABLE RED-1: POTENTIAL RED EFFECTS TO FLOOD RISK MANAGEMENT

RED FACTOR	POTENTIAL RED EFFECTS
Construction	Additional construction related activity and resulting spillovers to suppliers
Revenues	Increased local business revenues as a consequence of reduced flooding, particularly from catastrophic floods
Tax Revenues	Increased income and sales taxes from the direct project and spillover industries
Employment	Short-term increase in construction employment; with catastrophic floods, significant losses in local employment (apart from the debris and repair businesses, which may show temporary gains)
Population Distribution	Disadvantage groups may benefit from the creation of a flood-free zone
Increased Wealth	Potential increase in wealth for floodplain residents as less is spent on damaged property, repairs, etc.; potential increase in property values.

RECONS SOFTWARE

A variety of software programs are available to measure the RED impacts of a project. The Corps of Engineers' Institute for Water Resources (IWR) along with the Louis Berger Group has developed a regional economic impact modeling tool called Regional Economic System (RECONS) that computes estimates of regional and national job creation, retention, and other economic measures. The expenditures made by the USACE for various services and products generate economic activity that can be measured in jobs, income, sales, and gross regional product (GRP). The software automates calculations and generates estimates of economic measures associated with USACE's annual civil works program spending. RECONS was built by extracting multipliers and other economic measures from more than 1,500 regional economic models that were built specifically for USACE's project locations by the Minnesota IMPLAN Group. These

multipliers were then imported into a database. The software ties various spending profiles to the matching industry sectors by location to produce economic impact estimates. The RECONS program is used to document the performance of direct investment spending of the USACE, and allows users to evaluate project and program expenditures associated with annual expenditures.

REGIONAL PROFILE

The economic impacts presented below show the Lower San Joaquin River Feasibility study area and the state of California's interrelated economic impacts resulting from an injection of flood risk management construction funds. For this assessment, the study area and the state of California were both used as the geographic designation to assess the overall impacts to the regional economy from constructing the TSP. This places a frame around the economic impacts where the activity is internalized; leakages, which are payments made to imports or value added sectors that do not in turn re-spend the dollars within the area, are not included in the total impacts.

Table summarizes the complex nature of the regional economy of the Stockton, CA Metropolitan Statistical Area (MSA), which has a population of approximately 750,000. There are approximately 288,000 people employed in the MSA who provide an output to the nation of nearly $40 billion annually.

TABLE RED-2: REGIONAL PROFILE – STOCKTON, CA MSA (DOLLAR VALUES IN $MILLIONS, OCTOBER 2014 PRICE LEVEL)

INDUSTRY	OUTPUT	LABOR INCOME	GRP	EMPLOYMENT
Accommodations and Food Service	$968	$328	$495	17,075
Administrative and Waste Management Services	$929	$482	$606	16,388
Agriculture, Forestry, Fishing and Hunting	$2,197	$614	$1,046	19,679
Arts, Entertainment, and Recreation	$227	$64	$104	2,872
Construction	$2,773	$1,151	$1,260	18,849
Education	$823	$609	$681	14,617
Finance, Insurance, Real Estate, Rental and Leasing	$3,348	$783	$2,222	18,799
Government	$3,041	$2,348	$2,665	34,727
Health Care and Social Assistance	$2,735	$1,503	$1,762	30,375
Imputed Rents	$3,022	$447	$1,904	17,145
Information	$1,787	$196	$387	3,219
Management of Companies and Enterprises	$303	$132	$176	1,492
Manufacturing	$9,093	$1,335	$2,155	21,820
Mining	$74	$23	$45	230
Professional, Scientific, and Technical Services	$1,215	$505	$682	9,394
Retail Trade	$2,362	$1,015	$1,616	32,939
Transportation and Warehousing	$2,033	$897	$1,268	16,116
Utilities	$1,082	$176	$408	1,235
Wholesale Trade	$1,871	$703	$1,208	11,425
Total	$39,883	$13,311	$20,690	288,396

INPUT COSTS

The RED analysis requires the adjustment of costs for two items: (1) interest during construction (IDC) and (2) purchases of land. Interest during construction is used in the NED analysis to estimate the opportunity cost of using money for one economic endeavor (*e.g.*, building a FRM project) instead of another (*e.g.*, building a bullet train); IDC is not actually expended within the region and therefore is not included in the RED analysis. Similarly, the purchase of land, not including administrative costs, is considered a transfer payment from one party to another and therefore is also not included in the RED analysis.

Tables RED-3 shows the regional expenditures expected over the construction period for the Recommended Plan. Local capture rates are provided by RECONS and show where the output from expenditures is realized.

TABLE RED-3: INPUTS ASSUMPTIONS—STOCKTON, CA MSA—ALTERNATIVE LS-7A

CATEGORY	SPENDING	SPENDING AMOUNT ($)	LOCAL PERCENTAGE CAPTURE		
			LOCAL	STATE	NATIONAL
Aggregate Materials	8.3%	43,076,775	74%	77%	97%
Other Materials	1.1%	5,916,871	100%	100%	100%
Equipment	29.2%	150,993,640	82%	99%	100%
Construction Labor	46.1%	238,602,790	100%	100%	100%
Explosives Materials	0.1%	439,572	8%	47%	86%
Cement Materials	0.3%	1,794,919	7%	73%	92%
Metals and Steel Materials	1.2%	6,263,901	18%	56%	90%
Machinery Materials	0.5%	2,710,694	13%	46%	79%
Electrical Materials	0.6%	3,150,266	19%	44%	80%
Lumber Materials	0.1%	439,572	24%	56%	90%
Fish Hatcheries, Wildlife Facilities, and Sanctuaries Maintenance and Upgrades	9.6%	49,820,000	100%	100%	100%
Cultural Resources Protection Activities	2.8%	14,592,000	40%	99%	99%
TOTAL	**100.0%**	**517,801,000**	**88.5%**	**96.4%**	**99.3%**

RECONS OUTPUT

The expenditures made by the Corps of Engineers for various services and products are expected to generate additional economic activity, which can be measured in jobs, income, sales, and GRP. Regional, state, and national impacts are summarized in Table RED-4. Detailed accounts of these economic impacts are shown in Tables RED-5 through RED-7.

TABLE RED-4: SUMMARY OF ECONOMIC IMPACTS (MONETARY VALUES IN $1,000S)

IMPACT	IMPACT		
	REGIONAL	STATE	NATIONAL
Output	$802,935	$1,016,661	$1,371,534
Jobs	8,795	9,955	11,906
Labor Income	$433,463	$510,647	$624,475
GRP	$571,958	$694,794	$888,589

TABLE RED-5: REGIONAL ECONOMIC IMPACTS—ALTERNATIVE LS-7A (MONETARY VALUES IN $1,000s)

Industry Sector	Sales	Jobs	Labor Income	GRP
Direct Effects				
Scientific research and development services	$5,882	43	$2,447	$2,450
Maintenance and repair construction of nonresidential structures	$49,796	317	$22,545	$28,368
All other chemical product and preparation manufacturing	$5	0	$0	$1
Cement manufacturing	$0	0	$0	$0
Steel product manufacturing from purchased steel	$406	1	$85	$101
Other industrial machinery manufacturing	$51	0	$16	$19
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$15,675	74	$9,334	$10,445
Switchgear and switchboard apparatus manufacturing	$233	1	$52	$108
Wholesale trade businesses	$1,484	9	$560	$1,119
Retail Stores - Furniture and home furnishings	$23	0	$8	$14
Retail Stores - Electronics and appliances	$69	1	$22	$37
Retail Stores - Building material and garden supply	$4	0	$2	$3
Transport by air	$1	0	$0	$0
Transport by rail	$1,151	3	$353	$611
Transport by water	$327	1	$83	$159
Transport by truck	$14,937	109	$7,253	$8,543
Construction of other new nonresidential structures	$5,917	34	$2,488	$3,096
Commercial and industrial machinery and equipment rental and leasing	$123,305	382	$34,237	$69,882
Labor	$238,603	5,301	$238,603	$238,603
Engineered wood member and truss manufacturing	$51	0	$17	$21
Total Direct Effects	457,921	6,276	318,106	363,580
Secondary Effects	345,014	2,520	115,357	208,378
Total Effects	**802,935**	**8,796**	**433,463**	**571,958**

TABLE RED-6: STATE ECONOMIC IMPACTS—ALTERNATIVE LS-7A (MONETARY VALUES IN $1,000s)

Industry Sector	Sales	Jobs	Labor Income	GRP
Direct Effects				
Scientific research and development services	$14,400	104	$7,624	$7,630
Maintenance and repair construction of nonresidential structures	$49,796	317	$22,545	$28,368
All other chemical product and preparation manufacturing	$162	0	$25	$37
Cement manufacturing	$1,122	2	$251	$510
Steel product manufacturing from purchased steel	$2,456	5	$513	$609
Other industrial machinery manufacturing	$742	3	$239	$279
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$16,536	79	$9,847	$11,019
Switchgear and switchboard apparatus manufacturing	$768	2	$172	$356
Wholesale trade businesses	$2,582	15	$1,044	$1,974
Retail Stores - Furniture and home furnishings	$33	0	$13	$21
Retail Stores - Electronics and appliances	$108	1	$42	$63
Retail Stores - Building material and garden supply	$4	0	$2	$3
Transport by air	$11	0	$3	$5
Transport by rail	$1,151	3	$353	$611
Transport by water	$340	1	$86	$165
Transport by truck	$14,937	109	$7,253	$8,543
Construction of other new nonresidential structures	$5,917	34	$2,488	$3,096
Commercial and industrial machinery and equipment rental and leasing	$149,354	465	$41,470	$84,645
Labor	$238,603	5,301	$238,603	$238,603
Engineered wood member and truss manufacturing	$163	1	$54	$68
Total Direct Effects	499,184	6,442	332,625	386,605
Secondary Effects	517,476	3,512	178,022	308,189
Total Effects	**1,016,661**	**9,954**	**510,647**	**694,794**

TABLE RED-7: NATIONAL ECONOMIC IMPACTS—ALTERNATIVE LS-7A (MONETARY VALUES IN $1,000s)

Industry Sector	Sales	Jobs	Labor Income	GRP
Direct Effects				
Scientific research and development services	$14,406	104	$7,628	$7,634
Maintenance and repair construction of nonresidential structures	$49,806	317	$22,549	$28,374
All other chemical product and preparation manufacturing	$331	1	$55	$80
Cement manufacturing	$1,464	3	$328	$666
Steel product manufacturing from purchased steel	$4,538	9	$947	$1,125
Other industrial machinery manufacturing	$1,634	7	$525	$614
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	$23,911	126	$14,239	$15,933
Switchgear and switchboard apparatus manufacturing	$1,899	5	$447	$922
Wholesale trade businesses	$2,617	15	$1,059	$2,001
Retail Stores - Furniture and home furnishings	$34	0	$13	$22
Retail Stores - Electronics and appliances	$108	1	$42	$63
Retail Stores - Building material and garden supply	$4	0	$2	$3
Transport by air	$15	0	$4	$7
Transport by rail	$1,359	4	$420	$723
Transport by water	$492	1	$125	$239
Transport by truck	$15,727	115	$7,636	$8,995
Construction of other new nonresidential structures	$5,917	34	$2,488	$3,096
Commercial and industrial machinery and equipment rental and leasing	$150,773	471	$41,864	$85,450
Labor	$238,603	5,301	$238,603	$238,603
Engineered wood member and truss manufacturing	$311	2	$102	$129
Total Direct Effects	513,950	6,516	339,077	394,679
Secondary Effects	857,584	5,389	285,399	493,910
Total Effects	**1,371,534**	**11,905**	**624,475**	**888,589**

US Army Corps of Engineers®
Sacramento District
Engineering Division

Lower San Joaquin Feasibility Study – Environmental Impact Report/ Supplemental Environmental Impacts Statement

San Joaquin County, California

Appendix B: Engineering Summary

December 2017

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ACRONYMS

ACE	Annual Chance Exceedance
ACRA	Abbreviated Cost Risk Analysis
ASTM	American Society for Testing and Materials
CFS	cubic feet per second (flow)
CM	Construction Management
CS	Central Stockton (geographical area)
CVHS	Central Valley Hydrology Study
CWWBS	Civil Works Work Breakdown Structure
DRMS	Delta Risk Management Study
DSM	Deep Soil Mixing
DWR	California Division of Water Resources
EC	Engineer Circular
ED	Engineering Division (USACE)
EO	Executive Order
ESA	Environmental Site Assessment ID
ETL	Engineer Technical Letter (USACE)
ER	Engineer Regulation
FEMA	Federal Emergency Management Agency
FLO-2D	Flood routing model simulating channel flow, unconfined overland, and street flow over complex topography
GIS	Geographic Information Systems
HEC-HMS	Hydraulic Engineering Center – Hydraulic Modeling System
HEC-RAS	Hydraulic Engineering Center – River Analysis System
HTRW	Hazardous, Toxic, Radioactive Waste
HQ	Head Quarters (USACE)
IDC	Interest During Construction
LiDAR	Light Detection and Ranging
LMA	Local Management Agency
LS, LSJ	Lower San Joaquin
LSJFS	Lower San Joaquin Feasibility Study
MCACES	Micro-Computer Aided Cost Estimating System
NAD	North American Datum
NAVD	North American Vertical Datum
NS	North Stockton (geographical area)
NSSDA	National Standards for Spatial Data Accuracy
OMRR&R	Operation and Maintenance, Repair, Replacement and Rehabilitation
PACR	Post Authorization Change Report
PCET	Parametric Cost Estimating Tool
PDT	Project Development Team
PED	Preconstruction, Engineering, and Design
RD	Reclamation District
RE	Real Estate

ACRONYMS (Cont'd)

RMSE(r)	Root Mean Square Error in r
RMSE(z)	Root Mean Square Error in z
ROW	Right of Way
RP	Recommended Plan
SEWD	Stockton East Water District
SJAFCA	San Joaquin Area Flood Control Agency
SJR	San Joaquin River
SLR	Sea Level Rise
SoP	Standard of Practice
SPK	Sacramento District (USACE)
TPCS	Total Project Cost Summary
TSP	Tentatively Selected Plan
ULDC	Urban Levee Design Criteria
UNET	one dimensional unsteady flow model for open channel flow
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VE	Value Engineering (study)
WTP	Water Treatment Plant

CHAPTER 1 – INTRODUCTION

1.1 Project Description and Background

Since initiating the Lower San Joaquin Feasibility Study (LSJFS), the Project Delivery Team (PDT) representatives have developed a comprehensive flood control plan for San Joaquin County. The PDT initially developed a framework based on known constraints from the varying organizations. The federal constraints centered on adhering to Corps of Engineers (Corps) study policies for a project to be authorized for federal construction funding. The goal of the California Division of Water Resources (DWR) was the completion of the study by January 2015 to meet the goal of registering the project for state bond appropriations during the same month. San Joaquin Area Flood Control Agency's (SJAFCA) goal was the continuing effort to provide safety to their community during rising floods.

While the LSJFS began as a traditional feasibility study, it was later reprogrammed under the new Corps planning modernization 3x3x3 (3^3) and as such and was placed on a shorter schedule with matching appropriations. The transition to 3^3 occurred during the winter/spring of 2012. The original study began approximately a year earlier in the fall of 2010.

1.2 Purpose and Scope

This summary provides a synopsis of the engineering analysis conducted during the feasibility work phase of the study by the engineering portion of the PDT. The objective is to summarize the designs and cost estimates completed through the final array of alternatives and recommended plan (formerly the TSP).

1.3 Sponsors

The LSJFS was initiated as a cost share agreement between SJAFCA and the Corps in February of 2009. The Central Valley Flood Protection Board represented by the California DWR signed on as a secondary non-federal sponsor in July of 2010. The local sponsor's design team was represented by Peterson Brustad, Inc.

CHAPTER 2 – GENERAL DESIGN CONSIDERATIONS

2.1 General

The goal of the engineering appendix is to provide a summary of the methods developed to reduce flood damages. The recommended flood risk reduction area is provided in Figure 1.

2.2 Datum

The North American Datum of 1983 (NAD 83) State Plane California Coordinate System Zone III (U.S. Survey Feet) was used for horizontal control. The North American Vertical Datum of 1988 (NAVD 88) was used as the vertical datum.

2.3 Alignment and Segments

2.3.1 Incremental Study Segments thru Final Array

Following the preliminary screening effort, levees which qualified for the initial screening were estimated for fix-in-place construction and associated costs as small segments. Fix-in-place costs were estimated for small segments to provide flexibility during the refinement stages of alternatives analysis. These smaller segments allow the refinements to add or delete segments incrementally. The study area contains 92 miles of levee which were classified into approximately 130 segments that were on average 3,700 feet in length. The result of this segmentation is presented in Figures 2 through 5.

Segment stationing went unchanged during the various phases of the study. The packaging of the number of segments varied as segments were added or deleted depending on the formulation of the array.

2.4 Alternative Reaches

2.4.1 Geographical Study Segments

Study segments were developed geographically based on the adjacent water feature or tract name. Segments were created for Mosher Creek, Fourteen Mile Slough, the Calaveras River, the delta front levees between Mosher Creek and the Calaveras River, Mormon Channel, Stockton Diverting Canal, Smith Canal, San Joaquin River, French Camp Slough, Duck Creek, and Paradise Cut Bypass. A geographical feature would often dictate where a segment would begin or end. These geographical features which were used as natural starting and stopping locations were highways, levee embankments, water features, embankments, etc. See 2.3.1 for additional information, and map Figures 2 through 5 for individual segments.

2.4.2 Initial Alternatives

Lists of measures were created by the PDT during the planning charette of January 2013 to use in the formulation of alternative plans. A measure is a feature or an activity that can be implemented at a specific geographic site to address one or more planning objectives. For example, a measure could be a fix for an earthen levee such as a cut-off wall or seepage berm.

The measures were categorized into structural and non-structural solutions. Seventy-three measures were identified as potential options for the study. The six criteria which were used to rank the 73 measures were meets objective, cost, environmental impacts, acceptability (by the community), completeness, and 21st century flood plain management.

The decision to consider a measure was based on its ranking among the 6 criteria used to rank the measures including a geotechnical engineering recommendation, and a decision to implement based on need. The 73 measures were reduced to 22 measures after ranking the measures based on the criteria. Measures were identified for 3 distinct geographical areas. The areas were divided into North Stockton, Central Stockton, and Reclamation District (RD) 17 (South Stockton). Six alternatives were recommended for North Stockton, five alternatives were recommended for Central Stockton, and five alternatives were recommended for RD17. The alternatives were created through a combination of flood containment using hydraulic breach scenarios plus a common sense approach to reach lengths which might terminate at highways or high ground. The Mormon Channel bypass and Paradise Cut options were recommended as incremental alternatives for further evaluation during the Value Engineering Study. The Mormon Slough bypass diverts excess flows off the Stockton Diverting Canal and the Calaveras River. Approximately 12 miles south of Stockton is a bypass called Paradise Cut. Paradise Cut is connected to the San Joaquin River with a weir which spills during high water events and diverts flood flows from the river. This study looked at the possibility of expanding Paradise Cut making it more viable at diverting water from the San Joaquin River during high water events. Tables 1, 2, and 3 in the appendix provide further details of the initial arrays. Figure 6 through 8 are provided as representative alternatives for North Stockton, Central Stockton, and RD-17 areas respectively.

2.4.3 Focused Array

Hydraulic design provided model runs of breach simulations which were performed for the initial alternatives. Some of the alternatives were modified based on their performance after a levee breach. An example of flooding containment is shown for the North Stockton area in Figure 9. The results from Figure 9 were used as a tool by the hydraulic designer to further refine alternatives.

The following summarizes a focused array used to begin identifying the recommended plan (formerly the TSP). Where it states "No Bypass" refers to an alternative which does not recommend the Mormon Channel bypass.

Alternative 1: The No-Action Alternative. Under this plan no effort is made to further reduce the risk of flooding. The areas identified in the initial alternatives are a combination of project and non-project levees which either have geometric deficiencies, height deficiencies, through and under seepage issues, landside stability, or erosion issues.

Alternative 2A – Fix-in-Place, No Bypass: Alternative 2A is a combination of North Stockton Alternative F, Central Stockton Alternative D, and RD17 Alternative E.

Table A. Description of Implementing Alternative 2A (Figure 11)

Initial Alternative Features	Specific Features: Smith Canal, Mosher Slough and 14 Mile Slough Closure Structures.
NS-F, CS-D, RD-17-E	
Description: Delta front north and south, and Calaveras River. Addresses the right bank of the Calaveras River and the delta front as flooding sources. This alternative includes closure structures across Mosher Slough and Fourteen Mile Slough. Additionally the Calaveras River, Stockton Diverting Canal, San Joaquin River (SJR), French Camp Slough and Duck Creek are identified as flooding sources which includes the Smith Canal closure structure. The north portion of the SJR of RD-17 with a tieback levee and levee extension address the San Joaquin River and French Camp Slough as flooding sources.	

Alternative 2A is shown in Figure 11 for reference. A further evolution of Alternative 2A provides for levee improvements connecting the existing Delta Front levees to the railroad tracks along the north bank of Mosher Slough. Figure 11 does not show the Mosher Slough levee as part of the alternative which was included later.

Alternative 2B – Fix-in-Place, No Bypass: Alternative 2B is a combination of North Stockton Alternative B, Central Stockton Alternatives B and C, and RD-17 Alternative E.

Table B. Description of Implementing Alternative 2B (Figure 12)

Initial Alternative Features	Specific Features: Smith Canal, Mosher Slough and 14 Mile Slough Closure Structures.
NS-B, CS-B, CS-C, RD-17-E	
Description: Delta front north and south, Calaveras River and SJR address the delta and tidal portion of the Calaveras River as flooding sources. The alternative includes closure structures across Mosher Slough, Smith Canal, and 14 Mile Slough. For the San Joaquin River front in Central Stockton the SJR, French Camp Slough, and Duck Creek are addressed as sources of flooding. The SJR north with tieback and extension in RD-17 address the SJR and French Camp Slough as flooding sources. This alternative also extends the tieback levee to address flanking issues.	

Alternative 2B is shown in Figure 12 for reference. A further evolution of Alternative 2B provided for levee improvements connecting the existing delta front levees to the railroad tracks along the north bank of Mosher Slough. The delta front levees are denoted by the pink outlined area (erosion protection in the legend) of Figure 15. Figure 12 does not show the Mosher slough levee as part of the alternative which was included later.

Alternative 3 – Fix-in-Place with Bypass: Alternative 3 is Alternative 2B (North Stockton Alternative B, Central Stockton Alternatives B and C, and RD-17 Alternative E) with the addition of the Mormon Channel Bypass (Figure 10).

Table C. Description of Implementing Alternative 3 (Figure 13)

Initial Alternative Features	Specific Features: Smith Canal, Mosher Slough, Mormon Channel bypass, and 14 Mile Slough Closure Structures.
NS-B, CS-B, CS-C, RD-17-E, Mormon Slough Bypass	
Description: The delta and tidal portion of the Calaveras River, and SJR are addressed as flooding sources. The alternative includes a closure structure across Mosher Slough and Smith Canal. Additionally the San Joaquin River, French Camp Slough, and Duck Creek are addressed as sources of flooding. For RD-17 the north portion of the SJR with levee tieback and levee extension are included. This alternative addresses the San Joaquin River and French Camp Slough as flooding sources. The alternative includes the Mormon Channel bypass which diverts floods off the Stockton Diverting Canal and the Calaveras River.	

Alternative 3 is shown in Figure 13 for reference. A further evolution of Alternative 3 provided for levee improvements connecting the existing delta front levees to the railroad tracks along the north bank of Mosher Slough. Figure 13 does not show the Mosher Slough levee as part of the alternative which was included later. Alternative 3 evolved into Alternatives 7, 8, 9, and 10.

Further evolution of alternatives included levee raises which became Alternative 4. For more detailed information on the focused array, reference the integrated feasibility report.

2.4.4 Final Array

The final array contained combinations of the best hydraulically performing and economically justified alternatives from the focused array. A majority of the alternatives reduced residual damages to a point where additional measures couldn't be justified. The economic analysis conducted during evaluation of the focused array of alternatives evaluated if increases in levee height would be economically justified. It was determined that the NED incrementally justified levee raises also meet the DWR Urban Levee Design criteria (ULDC) for 2070 sea level conditions. All alternatives presented in the final array include incrementally justified levee raises that meet ULDC requirements in 2070.

Final array alternatives are provided in Table D. A new naming convention was used for the final array alternatives. As seen below, focused array alternative 2B plus levee raises for sea level rise is labeled LS-7b, focused array 2A plus sea level raise is labeled LS-8b. Refer to Table D for further nomenclature.

Table D. Final Array of Alternatives Information for the LSJ Study

Focused Name	Final Name	Information	Geographical Areas
2B + SLR[1] (LS-7)	LS-7b	Cut-off Wall (>75% of the fix), ~ 42 repair miles, construction footprint: ~ 364 acres	North, Central, RD-17 (Delta Front, Lower Calaveras, and San Joaquin River Levee Improvements)
2A + SLR (LS-8)	LS-8b	Cut-off Wall (>80% of the fix), ~ 53 repair miles, construction footprint: ~ 418 acres	North, Central, RD-17 (Delta Front, Lower Calaveras, Stockton Diverting Canal, and San Joaquin River Levee Improvements)
3 + SLR (LS-9)	LS-9b	Cut-off Wall (~80% of the fix), ~ 43 repair miles, construction footprint: ~ 401 acres	North, Central, RD-17 (Delta Front, Lower Calaveras, San Joaquin River Levee Improvements and Mormon Channel Bypass)
LS-7 w/o RD-17	LS-7a	Cut-off Wall (>85% of the fix), ~ 23 repair miles, construction footprint: ~152 acres	North and Central Stockton (Delta Front, Lower Calaveras, San Joaquin minus RD-17)
LS-8 w/o RD-17	LS-8a	Cut-off Wall (>90% of the fix), ~ 33 repair miles, construction footprint: ~ 214 acres	North and Central Stockton (Delta Front, Lower Calaveras, Stockton Diverting Canal, San Joaquin minus RD-17)
LS-9 w/o RD-17 (LS-10)	LS-9a	Cut-off Wall (>92% of the fix), ~ 33 repair miles, construction footprint: ~ 219 acres	North and Central Stockton (Delta Front, Lower Calaveras, San Joaquin minus RD-17, Mormon Channel Bypass)

[1] – SLR is sea level rise

As a result of the analysis required for compliance with E.O. 11988, the RD 17 alternatives were removed from further consideration in the feasibility study. This action results in a policy compliant array of the following alternatives for identification of the NED and recommended plan (formerly the TSP): Alternative 7a, Alternative 8a, and Alternative 9a.

It is understood that RD 17, with funding assistance from the State, is currently pursuing a phased strategy of levee improvements to initially increase the resistance of RD 17's levee system to under seepage and through seepage. Upon completion of that work, RD 17 intends to request USACE participation in additional improvements necessary to achieve 200-year (0.5 percent ACE) flood risk management in order to meet SB 5 requirements. Consideration of future federal participation would be

subject to demonstration of a federal interest in such incremental improvements. The following summaries are provided which were used to select the recommended plan (formerly the TSP), or was information that was provided as part of the recommended plan.

2.5 Topographic Data

2.5.1 General

The primary source of topographic or terrain data for the construction of the HEC-RAS models was LiDAR data compiled by DWR under the Central Valley Floodplain Evaluation and Delineation Study (CVFED) and Delta Risk Management Study (DRMS). The minimum expected horizontal accuracy was tested to meet or exceed a 3.5-foot horizontal accuracy at 95 percent confidence level using RMSE(r) x 1.7308 as defined by the National Standards for Spatial Data Accuracy (NSSDA). Final ground surface LiDAR point elevation data in areas other than open terrain meet or exceed NSSDA standards of 0.6 feet RMSE vertical (Accuracy z = 1.2 feet at the 95% confidence level). Accuracy was tested to meet a 0.6-foot fundamental vertical accuracy at 95 percent confidence level using RMSE(z) x 1.9600 as defined by the NSSDA. The horizontal datum is NAD83 (2007) and the vertical datum the North American Vertical Datum of 1988 (NAVD88). CVFED LiDAR data was acquired in a period of several weeks between March 17, 2008 and April 4, 2008.

2.6 Hydrology

2.6.1 General

Hydrology for the San Joaquin River was based on analysis conducted by the California Department of Water Resources (DWR) and USACE for the 2002 Sacramento-San Joaquin Comprehensive Study. Hydrology for the Calaveras River and Mormon Slough was based on analysis conducted for the feasibility study between 2010 and 2014 by the local sponsors and USACE and followed procedures compatible with the California Department of Water Resources Central Valley Hydrology Study (CVHS). The following provides a summary of the hydrologic flow frequency analysis utilized as inputs to hydraulic analysis.

a. San Joaquin River. The upstream boundary for the San Joaquin River hydraulic model is the USGS stream gage San Joaquin River near Vernalis. The drainage area at the stream gage is 13,536 square miles. Records at the USGS stream gage only account for flow in the channel and do not account for overbank flow. During large floods, flow on the waterside of the right bank levee outflanks the gage before discharging into the main channel at the RD17 tieback levee. Hydrologic frequency analysis presented herein accounts for all flow passing the gage, including channel and right overbank flow.

The Sacramento-San Joaquin Comprehensive study included the entire Sacramento and San Joaquin Valleys. Thirty-day regulated flow hydrographs developed for 50% (1/2) Annual Chance Exceedance (ACE), 10% (1/10) ACE, 4% (1/25) ACE, 2% (1/50) ACE, 1% (1/100) ACE, 0.5% (1/200) ACE, and 0.2% (1/500) was used in the hydraulic analysis.

The synthetic hydrology investigated unregulated flood frequencies at mainstem and tributary locations throughout the San Joaquin Basin. The evaluation of unregulated flows is a necessary

first step because a key assumption in frequency analysis is the flows reflect natural variability. The flood frequency analysis involved evaluations of long term historical records at the stream gages. The unregulated flow frequency statistics and period of record for the San Joaquin River near Vernalis were used to estimate hydrologic uncertainty for San Joaquin River reaches within the study area. The adopted statistics and period of record for the unregulated conditions are provided in Table E. A tabulation of the flood frequency estimates for flood durations between 1-day and 30-days is provided in Table F.

Table E.
Rain Flood Frequency Statistics, San Joaquin River near Vernalis, Unregulated Conditions

Flood Duration	Adopted Log Mean	Adopted Log Standard Deviation	Adopted Log Skew	Record (Years)	
				Years Evaluated	Years Used
1-Day	4.375	0.450	-0.1	1917 - 1998	82
3-Day	4.333	0.445	-0.1	1917 - 1998	82
7-Day	4.251	0.433	-0.2	1917 - 1998	82
15-Day	4.148	0.412	-0.2	1917 - 1998	82
30-Day	4.042	0.392	-0.2	1917 - 1998	82

Table F
Flood Frequency Flow Estimates, San Joaquin River near Vernalis, Unregulated Conditions

Flood Duration	Duration Average Discharge by ACE (CFS)						
	50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
1-Day	24100	88400	140300	188300	244700	310400	412900
3-Day	21900	79100	124900	167000	216500	273900	363100
7-Day	18400	62500	95200	124000	156500	193000	247300
15-Day	14500	46400	69200	89000	111100	135600	171700
30-Day	11400	34300	50200	63800	78700	95200	119200

The Comp Study formulated 5 mainstem and 22 tributary storm centerings to represent the many different possibilities of aerial storm distributions and antecedent watershed conditions. For each centering, synthetic 30-day natural flow hydrographs were computed at locations throughout the Central Valley. Typically, each tributary basin was composed of several hydrographs representing inflow to headwater dams, flood control dams, and local flow. The various hydrographs were then routed to specific index points to create an unregulated hydrograph (such as San Joaquin River at Vernalis). These natural flow hydrographs represent flood time series produced by a wholly unimpaired drainage area. The unimpaired hydrographs do not reflect the influence of headwater reservoirs. The hydrographs were balanced so the average flow for all durations matched the given frequency. For example, the peak, 1-day, 3-day, 5-day, 15-day, and 30-day volumes match the family of unregulated frequency curves computed for this location.

To simulate existing conditions, a 3-step process was required to conduct simulations of reservoir regulations for each storm centering. To begin the sequence, the headwaters reservoirs upstream of the flood control reservoirs were simulated. Then, using the resulting storage time series for select headwater facilities, top of conservation storage for those flood damage reduction projects with established credit space agreements were computed. Next, using the results of the

headwater simulations and the computed top of conservation series, the lower basin reservoir models were simulated, thereby completing the reservoir simulation procedure.

A regulated set of hydrographs was obtained from "hand off" points in the lower basin reservoir simulation model. These hydrographs were then used as input to a UNET unsteady flow hydraulic model of the San Joaquin River. A review of the mainstem storm centerings found that the highest peak stages along the San Joaquin River within the study area are generated by the San Joaquin River at Vernalis storm centering. Therefore, hydraulic models for only one centering were evaluated in the feasibility study.

The sensitivity of downstream peak flows to upstream levee failures was conducted to determine if it would have a significant impact the evaluation of flood risk. The model was run for three different upstream levee failure scenarios.

(1) Infinite levee with no overtopping (Infinite). This is considered the extreme high estimate because no floodplain storage is allowed. All flow is confined to the leveed channel. This describes the extreme upper limit of potential peak flow at Vernalis relative to the levee assumption.

(2) Overtopping without Failure (No Fail). This model assumed all levees would overtop but would not fail. This may not be the most likely condition because some levees would likely fail prior to overtopping (probability of poor performance indicated by the fragility curve).

(3) With levee failure condition (With Fail). This model assumed all levees would fail at the 50% fragility point. This may not be the most likely condition because not all levees would fail at the 50% fragility point during the same flood.

A comparison of peak flows for the different levee assumptions is described in Table G. The comp study models were only run for floods larger than 10% ACE.

Table G
Sensitivity of Upstream Levee Failures, San Joaquin River near Vernalis Regulated Conditions

Levee Scenario	Peak Discharge by ACE (CFS)						
	50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
Infinite Levee	NA	36900	47000	58400	90800	145500	233700
No Failure	NA	35100	42300	47700	78200	144500	224100
With Failure	NA	32900	43000	50300	77300	113300	166600
Source: 2002 Sacramento-San Joaquin Comprehensive Study UNET model results.							

The peak flow of infinite height assumption was found to always be greater for a given ACE. The greatest difference between infinite height and no fail scenarios occurred at the 2% (1/50) ACE to 1% (1/100) ACE event which is probably around the floodmagnitude that most system levees are overtopped. The No-Fail and With-Fail conditions are similar for floods smaller than 1% (1/100) ACE. The No-fail is larger than the with-fail condition for floods larger than 1% (1/100) ACE. The most likely condition is probably between the no-fail and with-fail conditions.

The overtopping with no failure scenario was adopted as the most likely hydraulic condition for

this study to support the risk analysis. This probability of overtopping levee failure is accounted for the FDA model using a fragility curve that assumes 100% failure probability at the levee crest.

This assumption helps make a breach probability more statistically independent rather than dependent on each other and is consistent with historical observations that the probability of a breach does not appear to be highly dependent on other breaches occurring. There is no specific guidance on how to apply overtopping assumptions to system wide risk analysis. However, the approach is consistent with the other risk and uncertainty assumptions in the FDA model. The overtopping without failure assumption is also consistent with the DWR Urban Levee Design Criteria and FEMA mapping approaches. A table of adopted regulated peak flows for this study is provided in Table H. During large floods, floodwaters are conveyed by the channel and right overbank. Therefore, hydrographs for channel and right overbanks are required for events greater than a 1% (1/100) ACE event.

Table H
Flood Frequency Flow Estimates, San Joaquin River near Vernalis Regulated Conditions

Peak Flow	Peak Discharge by ACE (CFS)						
	50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
Chanel	6400	35100	42300	47700	78200	124600	165200
Right Overbank	0	0	0	0	0	20400	60500
Total	6400	35100	42300	47700	78200	144500	224100
Note: Peak channel plus right overbank flow may not equal peak total flow due to hydrograph timing.							

The California Department of Water Resources is currently conducting a study of Central Valley Hydrology. The Central Valley Hydrology Study (CVHS) will provide more recent hydrologic frequency estimates throughout the study area. However, the results were not finalized at the time of this study. The draft flood frequency estimates from the CVHS study were compared to the comp study estimates and found to be similar.

Calaveras River and Mormon Slough. The upstream hydraulic model boundary for and Calaveras River and Mormon Slough is the USACE stream gage Mormon Slough at Bellota. The drainage area at the gage is 470 square miles. Flood frequency curves and a suite of 10-day hydrographs were developed for the Mormon Slough at Bellota gage. The unregulated frequency analysis was performed with PeakfqSA software which uses the Expected Moments Algorithm (EMA) and Multiple Grubbs Beck outlier test. The method is approved for use by HQ USACE. The period of record analyzed is 104 years from 1907 to 2010. Unregulated flow frequency statistics for the Mormon Slough at Bellota Gage are provided in Table 14. Unregulated discharges by frequency and duration are provided in Table J. The analysis involved routing scaled versions of four large historic flood events (reservoir inflow plus local flow hydrographs) through an HEC-ResSim reservoir routing model. Four unregulated to regulated transforms were derived and then averaged to produce a final adopted peak regulated flow frequency curve. Selected regulated hydrographs at Bellota based on the 1997 flood pattern and matching the regulated peak flow frequency curve were adopted for input into HEC-RAS model for modeling specific frequency events at Bellota. A rainfall runoff model was used to derive concurrent local flow hydrographs as internal boundary conditions in the HEC-RAS hydraulic model reaches downstream of Mormon Slough at Bellota. A table of adopted regulated peak flows for this study is provided in Table K. Although the frequency analysis utilized 104 years of record, an equivalent period of record of 52-yrs should be utilized in performance analysis to account for uncertainty in estimating the ungaged unregulated

flow between New Hogan Dam and Bellota. It was reduced in half because of uncertainty about how efficiently the dam can operate to local flow conditions. This equivalent record was also adopted for multiple index points downstream of Bellota since approximately 75% or more of the total flow in the downstream levee reach is from sources upstream of Bellota.

Table I
Rain Flood Frequency Statistics, Mormon Slough at Bellota
Unregulated Conditions

Flood Duration	Adopted Log Mean	Adopted Log Standard Deviation	Adopted Log Skew	Record (Years)	
				Years Evaluated	Years Used for Statistics
1-Day	3.775	0.482	-0.810	1907 - 2010	104
3-Day	3.608	0.475	-0.753	1907 - 2010	104
7-Day	3.417	0.464	-0.666	1907 - 2010	104
15-Day	3.240	0.461	-0.671	1907 - 2010	104
30-Day	3.079	0.448	-0.668	1907 - 2010	104

Table J
Flood Frequency, Mormon Slough at Bellota
Unregulated Conditions

Flood Duration	Duration Average Discharge by ACE (CFS)						
	50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
1-Day	6900	21700	29700	35300	40500	45400	51300
3-Day	4600	14600	20200	24200	28000	31600	36100
7-Day	2900	9300	13000	15800	18500	21100	24500
15-Day	2000	6100	8600	10300	12100	13800	16000
30-Day	1300	4100	5700	6800	7900	9000	10400

A rainfall runoff model was used to derive concurrent local flow hydrographs as internal boundary conditions in the HEC-RAS hydraulic model reaches downstream of Mormon Slough at Bellota. A table of adopted regulated peak flows for this study is provided in Table K.

Table K
Flood Frequency, Mormon Slough at Bellota
Regulated Conditions

	Duration Average Discharge by ACE (CFS)						
	50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
Peak Flow	3520	9530	10640	12500	12500	12500	16000

b. Delta Stage-Frequency. A stage frequency analysis was conducted at four stream gages in the Sacramento-San Joaquin Delta that serve as downstream boundary conditions in the hydraulic models. The stage-frequency analysis was conducted for DWR stream gages; Old River at Clifton Court Ferry (B95340), Middle River at Bowden Highway (B95500), San Joaquin River at Ringe Pump (B95620), and Stockton Ship Channel at Burns Cutoff (B95660) . Stage-frequency estimates were developed for three future sea level conditions including 2010, 2020,

and 2070. The frequency analysis is described in detail in the "Technical Memorandum, Delta Stage- Frequency Analysis for Alternative Comparisons," 9 May 2014. The stage frequency curves are provided as Tables L and M.

The stage frequency analysis was based on stage data from the period from 1953 to 2009. Historical peak stages would have been higher under existing (2010) sea level conditions. Historical stage data were adjusted to 2010 sea level conditions for use in the frequency analysis. Each data set was adjusted by increasing historical recorded elevations to 2010 conditions using the eustatic rate of sea level rise of 0.0056 ft/yr (1.7mm/yr). The rate of eustatic sea level rise was obtained from ER 1100-2-8162 and agrees with the reported value in NOAA, 2013 as the estimated rate of sea level rise over the 20th century.

Graphical stage-frequency curves were developed for each gage by plotting the historical stage records using Weibul plotting positions. Extrapolation of the stage frequency curves from 2% ACE to 0.2% ACE events was based on hydraulic model simulations of the San Joaquin River system. For larger flood events the stage-discharge relationship at each gage was based on DSM2 model results presented in the March 2002 report "Sacramento and San Joaquin River Basins Comprehensive Study, Existing Hydrodynamic Conditions in the Delta during Floods". These relationships between stage and flow at each gage site are currently the best available analysis of hydraulic conditions in the delta for extreme flood events. While suitable for economic analysis, estimates should be refined for design purposes.

Future Sea level Rise was computed following the method outlined in ER 1100-2-8162 for four scenarios. The USACE Low estimate is based on the historical rate of sea level rise. The USACE Intermediate estimate is based on Curve I and reflects an intermediate estimate of the future rate of sea level rise. The USACE Curve II estimate reflects a rate greater than the intermediate rate. The USACE high estimate is based on curve III and reflects a high estimate of the future rate of sea level rise. Estimated increases in sea level for each scenario are provided in Table N.

The Curve II rates were used to estimate future increases in sea level over the period 2010 through 2070 in the economic analysis. The Curve II rate is higher than the intermediate rate and was selected for these four locations considering the uncertainty and consequences of flooding in a highly urbanized area. As described below, stages at the boundary locations are based on a combination of flow and tide elevations and increased flow could further increase the stage at these index points. Estimates of potential inland climate change are described in the Hydrology Addendum. Future sea level rise was assumed to impact all flood frequencies the same amount because the Delta consists of a network of channels that would have similar hydraulic characteristics for higher sea level conditions.

All elevations presented in this report are provided relative to the NAVD88 vertical datum as required by ER1110-2-816. The NAVD88 datum is maintained by the National Geodetic Survey (NGS) to be free from changes related to subsidence and plate tectonics. The NAVD88 datum reflects a constant geopotential surface which is the basis for hydrodynamic and hydraulic modeling, design, and construction. Future rates of Sea Level Rise relative to the NAVD88 datum were based on the changes in Sea Level.

Elevation changes related to subsidence or plate tectonics are accounted for as a reduction in the ground elevation relative to the NAVD88 datum over time. This approach is considered to provide a more accurate assessment of the impacts of sea level rise and localized ground subsidence than application of relative sea level rise estimates derived from nearby tidal gages which do not reflect the soil conditions underlying the proposed levee locations. In addition, the hydraulic effects of stage increases are different than subsidence in hydraulic models used to derive stages throughout the study area.

The subsidence component was estimated by reviewing NAVD88 elevations for three NGS benchmarks along the San Joaquin River within the study area. All three benchmarks indicated a similar amount of vertical change from the period 1998 to 2012. It was assumed the vertical change was due to subsidence but the value is also within the expected range of uncertainty in height modernization surveys conducted by the NGS over the period. In other words the differences might not be related to subsidence. All three benchmarks indicated a subsidence rate of about 0.02 feet (0.6 mm) per year during the period 1998 to 2012. This was considered to be a high estimate of the subsidence rate and would translate to about 2 feet of subsidence over 100 years. It is also important to consider that the observed differences at the NGS benchmarks may not reflect conditions for all features throughout the study area. For example, bridges are typically set on pile foundations that may not subside at the same rate as the natural ground and that might be different than a levee. It was assumed that a reasonable medium rate would be 0.01 feet per year and a low rate would be 0.005 feet per year.

For all alternatives it was assumed the design elevation would be maintained by the sponsor through normal operation and maintenance activities over the 100 year project life. As part of Operation and Maintenance the sponsor would be required to verify the crest elevation by conducting a high order survey every 10-years to update the National Levee Database. The sponsor would be required to restore the levee profile if it was found to have subsided more than 0.5 feet. This approach to addressing subsidence related issues is described as the "Managed adaptive approach" in ETL 1100-2-1. To support PED analysis, it is recommended that the National Levee Database Survey be re-conducted and compared to confirm the assumption of levee subsidence rates in the project area. This information would then be incorporated into the settlement portion of the design, or addressed in operations and maintenance. It is estimated the crest elevation would need to be restored every 25 years for reaches that subsided at the high rate and 50 years for reaches that subsided at the medium rate. No restoration would be anticipated for reaches that subsided at the low rate.

Table L
Mean Stage estimates by Annual Chance of Exceedance, No Action Alternative
2010 Sea Level Conditions

ACE	Mean Stage (Feet-NAVD88)			
	Old River at Clifton Court Ferry (B95340)	Middle River at Borden Hwy (B95500)	Stockton Ship Channel at Burns Cutoff (B95660)	San Joaquin River at Ringe Pump (B95620)
0.002 (1/500)	13.08*	11.20*	13.01*	12.91*
0.005 (1/200)	12.12*	9.90*	12.12*	12.02*
0.010 (1/100)	11.44*	9.80*	10.10*	10.00*
0.020 (1/50)	9.95	9.57	9.90	9.80
0.040 (1/25)	9.75	9.50	9.70	9.60
0.100 (1/10)	9.35	9.10	9.30	9.20
0.200 (1/5)	8.70	8.55	8.70	8.60
0.300 (1/3)	7.70	7.80	8.15	8.05
0.500 (1/2)	7.15	7.25	7.70	7.60
0.950 (1/1.05)	6.35	6.45	6.70	6.60

* Stage estimates for events larger than 0.02 (1/50) ACE are based on hydraulic model extrapolation. While suitable for economic analysis, estimates should be refined for design purposes.

Table M
Future Mean Stage estimates by Annual Chance of Exceedance, No Action Alternative
Curve II Rate of Sea Level Change

ACE	Mean Stage (Feet-NAVD88)			
	Old River at Clifton Court Ferry (B95340)	Middle River at Borden Hwy (B95500)	Stockton Ship Channel at Burns Cutoff (B95660)	San Joaquin River at Ringe Pump (B95620)
Sea Level Conditions in Year 2020				
0.002 (1/500)	13.24*	11.36*	13.17*	13.07*
0.005 (1/200)	12.28*	10.06*	12.28*	12.18*
0.010 (1/100)	11.60*	9.96*	10.26*	10.16*
0.020 (1/50)	10.11	9.73	10.06	9.96
0.040 (1/25)	9.91	9.66	9.86	9.76
0.100 (1/10)	9.51	9.26	9.46	9.36
0.200 (1/5)	8.86	8.71	8.86	8.76
0.300 (1/3)	7.86	7.96	8.31	8.21
0.500 (1/2)	7.31	7.41	7.86	7.76
0.950 (1/1.05)	6.51	6.61	6.86	6.76
Sea Level Conditions in Year 2030				
0.002 (1/500)	13.45*	11.57*	13.38*	13.28*
0.005 (1/200)	12.49*	10.27*	12.49*	12.39*
0.010 (1/100)	11.81*	10.17*	10.47*	10.37*
0.020 (1/50)	10.32	9.94	10.27	10.17
0.040 (1/25)	10.12	9.87	10.07	9.97
0.100 (1/10)	9.72	9.47	9.67	9.57
0.200 (1/5)	9.07	8.92	9.07	8.97
0.300 (1/3)	8.07	8.17	8.52	8.42
0.500 (1/2)	7.52	7.62	8.07	7.97
0.950 (1/1.05)	6.72	6.82	7.07	6.97
Sea Level Conditions in Year 2070				
0.002 (1/500)	14.74*	12.86*	14.67*	14.57*
0.005 (1/200)	13.78*	11.56*	13.78*	13.68*
0.010 (1/100)	13.10*	11.46*	11.76*	11.66*
0.020 (1/50)	11.61	11.23	11.56	11.46
0.040 (1/25)	11.41	11.16	11.36	11.26
0.100 (1/10)	11.01	10.76	10.96	10.86
0.200 (1/5)	10.36	10.21	10.36	10.26
0.300 (1/3)	9.36	9.46	9.81	9.71
0.500 (1/2)	8.81	8.91	9.36	9.26
0.950 (1/1.05)	8.01	8.11	8.36	8.26
Sea Level Conditions in Year 2120				
0.002 (1/500)	17.38*	15.50*	17.31*	17.21*
0.005 (1/200)	16.42*	14.20*	16.42*	16.32*
0.010 (1/100)	15.74*	14.10*	14.40*	14.30*
0.020 (1/50)	14.25	13.87	14.20	14.10
0.040 (1/25)	14.05	13.80	14.00	13.90
0.100 (1/10)	13.65	13.40	13.60	13.50
0.200 (1/5)	13.00	12.85	13.00	12.90
0.300 (1/3)	12.00	12.10	12.45	12.35
0.500 (1/2)	11.45	11.55	12.00	11.90
0.950 (1/1.05)	10.65	10.75	11.00	10.90

* Stage estimates for events larger than 0.02 (1/50) ACE are based on hydraulic model extrapolation. While suitable for economic analysis, estimates should be refined for design purposes.
Future Sea Level based ER 1100-2-8162 Curve II. Low, Intermediate, and High estimates can be computed using values in Table 19.

Table N. Sea Level Rise and Ground Subsidence from 2010 Conditions

Year	Sea Level Rise from 2010 Conditions (Feet)				Potential Ground Subsidence from 2010 Conditions (Feet)		
	USACE Low (Historic)	USACE Intermediate Curve I	**Adopted Curve II**	USACE High Curve III	Low	Medium	High
2010	0.00	0.00	**0.00**	0.00	0.00	0.00	0.00
2015	0.03	0.05	**0.07**	0.10	0.03	0.05	0.10
2020	0.06	0.10	**0.16**	0.23	0.05	0.10	0.20
2025	0.08	0.15	**0.26**	0.37	0.08	0.15	0.30
2030	0.11	0.21	**0.37**	0.53	0.10	0.20	0.40
2035	0.14	0.28	**0.49**	0.70	0.13	0.25	0.50
2040	0.17	0.34	**0.62**	0.90	0.15	0.30	0.60
2045	0.20	0.42	**0.77**	1.12	0.18	0.35	0.70
2050	0.22	0.49	**0.92**	1.35	0.20	0.40	0.80
2055	0.25	0.58	**1.09**	1.60	0.23	0.45	0.90
2060	0.28	0.66	**1.27**	1.87	0.25	0.50	1.00
2065	0.31	0.75	**1.46**	2.16	0.28	0.55	1.10
2070	0.34	0.85	**1.66**	2.47	0.30	0.60	1.20
2075	0.36	0.95	**1.87**	2.80	0.33	0.65	1.30
2080	0.39	1.05	**2.09**	3.14	0.35	0.70	1.40
2085	0.42	1.16	**2.33**	3.50	0.38	0.75	1.50
2090	0.45	1.27	**2.58**	3.89	0.40	0.80	1.60
2095	0.47	1.39	**2.84**	4.29	0.43	0.85	1.70
2100	0.50	1.51	**3.11**	4.71	0.45	0.90	1.80
2105	0.53	1.64	**3.39**	5.14	0.48	0.95	1.90
2110	0.56	1.77	**3.68**	5.60	0.50	1.00	2.00
2115	0.59	1.90	**3.99**	6.07	0.53	1.05	2.10
2120	0.61	2.04	**4.30**	6.57	0.55	1.10	2.20
Rate of Sea Level Rise based on ER 1100-2-8162.							

c. Interior Drainage. An interior drainage analysis was performed by Peterson-Brustad Incorporated (PBI) for Bear Creek, Mosher Creek, and French Camp Slough sub-basins impacting the study area. A storm centered over the urban area of Stockton was utilized for the analysis. The interior drainage analysis evaluated rainfall runoff and flood depths for 50% (1/2) ACE through 0.2% (1/500) ACE flood events. Storm events with 72-hour durations were evaluated. The analysis utilized an HEC-HMS model to compute sub basin runoff and a FLO-2D two dimensional hydraulic model to route the runoff through the study area. The analysis indicated that interior drainage was not a significant factor in estimating annualized flood damages within the study area. Therefore, interior drainage was not studied in further detail in the alternatives analysis.

The effects of sea level change are estimated to have minor impacts on interior drainage because the affected interior drainage area is currently drained by a system of detention ponds and pumps that evacuate the water to the adjacent delta sloughs. Increases in sea level are likely to result in a gradual increase in pump head and a corresponding reduction in the performance of the pumps over time. However, any increase in pump sizes necessary to maintain similar capacity are likely to be

addressed by the local community as the pumps reach the end of their normal service life.

2.7 Hydraulics

2.7.1 General

The following provides a summary of the hydraulic design and evaluation of the final array of alternatives.

a. Hydraulic Models: Four separate hydraulic models, adapted from existing hydraulic models, were utilized to evaluate the final alternatives for this study. Water surface profiles for the San Joaquin River were computed using a HEC-RAS unsteady one-dimensional flow model of the San Joaquin River system. Water surface profiles for Calaveras River and Mormon Slough were computed using a HEC-RAS one dimensional unsteady flow model of the system. Levee breach simulations for the area North of French Camp Slough were conducted using the North FLO-2D model. Levee breach simulations for the area south of French Camp Slough were conducted using the south FLO-2D model.

b. Hydraulic Design Features. Hydraulic design features incorporated into the alternatives included levee raises, erosion protection, closure structures and setback levees.

c. Wind Wave Analysis: An analysis of wind wave run-up, wind wave setup, overtopping discharge, and wind wave erosion was conducted for levee reaches within the study area. The results of the wind wave analysis determined that erosion protection was necessary along the western slope of the delta front levees to keep a breach from occurring.

d. Project Performance and Flood Risk. Performance and Flood Risk were assessed using the USACE FDA model version 1.2.5a (USACE, 2010). The FDA model combines flow-frequency, stage-discharge, geotechnical fragility, and stage-damage relationships to estimate damages. Uncertainty in each relationship is incorporated by assigning uncertainty estimates and applying a Monte Carlo type approach to combine the results.

e. Potential Adverse Effects. A potential adverse hydraulic effect would be induced flooding within the system. Induced flooding could result from a project increasing the depth, duration, or frequency of flooding. The potential for induced flooding was evaluated by comparing with-project and no action plans throughout the system. Depending on the location within the project area induced flooding was determined to be either equal to the no action alternative, or was reduced compared to the induced flooding potential for the no-action alternative. It was determined that the changes were not significant and no mitigation features would be required.

Climate Change. The delta reaches of the study area are affected by changes in sea level. Project performance was estimated for both 2010 (beginning of economic analysis) and 2070 (end of economic analysis) conditions using the hydraulic model

results for 2010 and 2070 sea level conditions at downstream boundary conditions.

f. California State Urban Level of Protection (ULOP). Although the California State Urban Levee of Protection is not a federal objective of the study, it is a local sponsor objective. For levees to meet the ULOP requirements they must be designed to meet the requirements in the State of California Urban Levee Design Criteria (ULDC).

The requirements for a levee to be recognized as contributing to an ULOP are defined in the May 2012 State of California report "Urban Levee Design Criteria" (DWR, 2012). The purpose of the Urban Levee Design Criteria (ULDC) is to provide engineering criteria and guidance for civil engineers to follow in meeting the requirements of California's Government Code Sections 65865.5, 65962, and 66474.5 with respect to findings that levees and floodwalls in the Sacramento-San Joaquin Valley provide protection against a flood that has a 1-in-200 chance of occurring in any given year (Annual Chance of Exceedance (ACE)), and to offer this same guidance to civil engineers working on levees and floodwalls anywhere in California (DWR, 2012).

The ULDC provides two options for determining if a levee meets the urban and urbanizing area levee system design.

- The freeboard option (option 1) requires 3 feet of freeboard above the median 0.5% (1/200) ACE flood event.
- The risk and uncertainty option (option 2) allows for a lesser amount of freeboard if a high level of assurance can be demonstrated. For assurance less than 90% the levee does not pass the ULDC criteria. For assurance between 90 and 95% the levee must have minimum of 3 feet of freeboard to pass the ULDC criteria. For assurance greater than 95% levee must have minimum of 2 feet of freeboard to pass the ULDC criteria.

Both ULDC approaches require that modeled water surface profiles assume other levees in the system can overtop, but not fail. Other urban area levees throughout the system are assumed to be at their existing elevation or 0.5% (1/200) plus 3 feet of freeboard, whichever is higher, and non-urban levees are assumed to be at their existing elevation or their authorized design profile, whichever is higher. Both ULDC approaches require that additional freeboard be provided if the wind-wave run-up from a 1.3% ACE wind event would exceed the top of levee for the 0.5% (1/200) ACE event. Both ULDC approaches also require minimum geotechnical, geometry, erosion control, vegetation, right of way, encroachment, and penetration standards, plus a number of other standards.

g. The hydraulic performance of each alternative relative to the ULOP requirements was conducted.

h. It was estimated that levee reaches in the recommended plan would meet the ULDC criteria if additional improvements to address outflanking of the existing RD17 tieback levee were made in the future. Increases in sea level to the year 2070 were considered in the evaluation. However, increases in flood flow frequency related to climate change were not considered. The State of California is currently conducting climate change studies with respect to flood flow frequency and these studies could impact this assessment. Project performance values provided in this report are based on the existing configuration of the RD17 tieback levee. Project

performance values are provided for both 2010 and 2070 sea level conditions. Inland climate change was not included because of the high degree of uncertainty.

i. General Hydraulic Design: All project features were designed to meet current USACE design requirements for stability and seepage. It should be noted there is no specific design requirements for levee height. The design height of the final alternatives is based on reasonably maximizing net benefits. The determination of maximum net benefits is described in the economic appendices and the plan formulation document.

2.8 Soil Design

2.8.1 General

The geotechnical work presents the results of the geotechnical analyses and feasibility level geotechnical recommendations to address technical deficiencies in the flood risk management system protecting the Lower San Joaquin River Feasibility Study area (LSJRFS). For the geotechnical engineering evaluation of the LSJRFS area, the following tasks were performed and summarized in the report:

- review of currently available geology, geomorphology, and geotechnical information
- review of past performance and flood control system construction history/improvements
- identification of levee performance deficiencies through geotechnical analysis and engineering judgment
- probabilistic geotechnical analysis and development of levee performance curves
- seismic study of existing levees
- development of geotechnical conclusions and recommendations

2.8.2 Design Criteria

USACE standard levee design and construction criteria as established in both national (HQ) and local (District and Division) policy documents were followed during analyses and development of mitigation regarding geometry, seepage and stability, vegetation and access, fill material, bank protection, and seismicity and liquefaction.

2.8.3 Evaluation of Existing Condition

Existing conditions were initially characterized by 14 Index points representing approximately 40-miles of existing levees within the study area. These 14 index points were selected for geotechnical analysis to represent the critical surface and subsurface conditions of each planning reach in order to identify the geotechnical deficiencies of the reach. The sections were selected based on previous geotechnical analysis, past levee performance, existing levee improvements, subsurface data, laboratory test results, surface conditions, field reconnaissance, and levee geometry. As part of the Planning process additional lengths of existing levees and also potential new levee alignments were added, expanding the project study area to roughly 90 miles. All of the existing and proposed levees with-project conditions were analyzed using the 14 index points. The index point locations are shown in Figure 1 and the dominant failure mechanism is listed in Table 4 of the appendix.

Potential sources of levee distress considered in the analyses were underseepage through the levee foundation, through-seepage through the levee embankment, and instability of the landside levee slope under steady state conditions. The levees were evaluated against the above mentioned performance modes at five different water surface elevations. Using this method of selecting loading conditions, the levee performance curves would theoretically represent probability of poor performance at multiple flood frequencies.

For the results of the fragility curve, a judgment based conditional probability function was provided based on the existing and past erosion history of the levee and riverbank, maintenance, encroachments, vegetation on the levee slopes and within the levee critical area, animal burrows and other external damaging conditions. The total conditional probability of poor performance of the levee as a function of water elevation was developed by combining the probability of poor performance functions for four failure modes: underseepage, through-seepage, slope instability, and judgment.

2.8.4 Conclusions

2.8.4.1 South Stockton

The analyses performed for South Stockton indicated that the levees represented by index points LR-1, LR-2, and LR-3 in RD-17 did not meet minimum levee design criteria at various flood frequencies. Historical documentation indicates performance-related issues with seepage, slope instability, and erosion. The measures identified in this study to mitigate these performance issues, to create with-project conditions, typically included a cutoff wall and/or seepage berm.

2.8.4.2 Central Stockton

The analyses performed for Central Stockton indicated that the levees represented by index points FR-1 in RD-404, and SL-1 and SL-2 along Stockton Diverting Canal did not meet minimum levee design criteria at various flood frequencies. Segments of the RD-404 levees can be identified in Table V. in 3.1.1. The segments can be located on Figures 2 or 4. Historical documentation indicates performance-related issues with seepage and erosion along RD-404, erosion along the left bank of the Calaveras River with isolated areas of seepage, and erosion along the left bank of Stockton Diverting Canal. The measures identified in this study to mitigate these performance issues, to create with-project conditions, typically included a cutoff wall and/or seepage berm.

2.8.4.3 North Stockton

The analyses performed for North Stockton indicated that the levees represented by index points CR-1/CR-2 and D-4 along the right bank of the Calaveras River, and index point D-BS along Delta Brookside, did not meet minimum levee design criteria at various flood frequencies. Historical documentation indicates performance-related issues with settlement, seepage, erosion, and animal burrowing activity along the Delta Brookside study area,

and seepage and erosion along Delta Lincoln Village study area. The Delta Brookside area is denoted by reaches CR_10_R, and segments TS_10_L thru TS_30_L in Figure 15. The Delta Lincoln Village area is denoted by reaches FS_10_R, FM_60_L, FM_40_L and FM_30_L on Figure 15. The measures identified in this study to mitigate these performance issues, to create with-project conditions, typically included a cutoff wall and/or seepage berm.

2.8.4.4 Seismic Study

The results of seismic and liquefaction evaluation indicated isolated areas throughout the study area that are capable of inducing significant deformation of the levees. Some of the levees in North Stockton are classified as frequently hydraulically loaded levees due to the tide and may be susceptible to significant deformation due to a seismic event. Most of the study area is unlikely to be capable of inducing flow failures, and significant deformation of the levees, however the Delta Lincoln Village and the levees north of Delta Brookside may be susceptible to significant deformation due to a seismic event. For seismic remediation, the measure identified includes deep-soil mixing columns that extend just beyond the extents of the levees prism.

2.8.5 Recommended Design Recommendation

With the exception of some proposed closure structures and set-back levees, the predominant project recommendation was fix-in-place of existing structures. The measure chosen to mitigate areas of poor performance was a cutoff wall and/or a seepage berm.

2.9 Civil Design

2.9.1 General

To begin estimating different alternatives for the focused array to final array, a computer based spreadsheet tool was used. The spreadsheet tool would ultimately help manage and produce preliminary estimates within the short time frame and resources the team faced under the new 3^3 planning modernization. The quantitative work was organized into cost reach segments as shown in Figures 2 through 5. Cost reaches were broken out considering a number of inputs including but not limited to: geotechnical deficiencies, changes in landside real estate, major infrastructure crossings, and hydrologic features.

2.9.2 Abbreviations and Names

The following abbreviations correspond to the location names shown on Figures 2 through 5, and for the cost estimating results below. The following abbreviations refer to Table O.

Table O. Names and Abbreviations for Levee Reaches for the North and Central Stockton Area and RD17

Abbreviation	Location Name
ST	Shima Tract (between Mosher Creek and Five Mile Creek)
MC	Mosher Creek
FM	Fourteen Mile Slough
FS	Five Mile Slough (between Shima Tract and Fourteen Mile Slough)
TS	Ten Mile Slough (between Fourteen Mile and Calaveras)
CR	Calaveras River
SDC	Stockton Diverting Canal
MS	Mormon Channel
SJR	San Joaquin River in the areas of the delta, RD404, and RD17
FCS	French Camp Slough
PTC	Potter Creek (SDC extension)
SC	Smith Canal
DC	Duck Creek (French Camp Slough extension)
PC	Paradise Cut

2.9.3 Parametric Estimating

The parametric software tool SPK used to calculate construction quantities is called PCET (parametric cost estimating tool) and is a spreadsheet tool to aid civil design calculate quantities based on known levee templates. The PCET program contains levee fix templates for calculating quantities by inputting geometric variables and design inputs. These variables conformed to EM 1110-2-1913 "Design and Construction of Levees," Sacramento District CESPK-ED-G, SOP-03: "Geotechnical Levee Practice," and ETL 1110-2-583 "Guidelines for Landscaping and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures." PCET inputs relied on Urban Levee Evaluation and National Levee Database datasets. These datasets provided geometric templates that could be selected to match the corresponding levee shape for Lower San Joaquin and apply a fix that could be used to calculate quantities efficiently. Unit costs were then applied to PCET outputs in order to determine parametric costs. These unit costs were based on past projects in the vicinity of Sacramento, adapted to the San Joaquin area.

The parametric estimates were used to capture a majority of costs associated with levee flood risk reduction features. Inputs provided to the PCET tool were provided by PDT members using available resources engineering judgment, following USACE criteria and policy. Special study features that could not be estimated with the PCET tool were captured under separate spreadsheet estimates. The cost and schedule risk analysis (CSRA) was also leveraged to account for known/unknown items which have come up in past construction projects.

The PCET tool covered a majority of the proposed levee improvements in the study area as described in paragraph 2.9.5. The tool also included allowances for unallocated items such as permitting, Storm Water Pollution Prevention, and unknown utilities. Site specific features were estimated separately from PCET where appropriate.

2.9.4 Segmental Cost Estimates

Based on experience with similar projects, the PDT began work using small project reach segments which could be incrementally added together for costing alternatives. This was a particularly useful strategy since the hydraulic flood plain and economic analysis work wasn't complete at the time and the alternative extents along with the federal interest was still being defined. The focused array study area contains 92 miles of levee which was evaluated using approximately 130 segments that were on average 3,700 feet in length. The result of this segmentation is presented in Figures 2 through 5. Figure 1 and Table 4 help define the resultant fix locations with relation to the closest index point.

2.9.5 Alternative Estimates

2.9.5.1 General Construction

Various cost estimates were prepared for focused and final array alternatives. The various estimates were based on quantities from geotechnical measures such as new levees, fixing existing levees, or incorporating new features within existing levees. Different types of fixes were then be applied to these measures such as cutoff walls, seepage berms, rock revetments, or general geometric improvements. In addition to these improvements, additional estimates were generated to capture facility and utility relocations resulting from the proposed features. Other cost considerations included real estate acquisitions, environmental and cultural resources mitigation, O&M, design costs, and construction management costs.

2.9.5.2 Construction with Raise

Corps guidance requires that sea level rise be taken into consideration per ETL 1100-2-1-1. The ensuing sea level rise (SLR) factors into the planning for existing project levee heights. The project economics indicated there was federal interest in raising levees to account for SLR in a few locations along RD17, North Stockton, Central Stockton and the Delta Front. In addition to the SLR improvements, there were raises in the lower RD17 area to provide increased assurance of passing the 200-yr event. These improvements were included into all of the alternatives. The sea level rise estimates were added to the final array of alternatives which created LS-7, LS-8 and LS-9. The raises were minimal and the incremental addition of SLR proved to be economically cost justified with increased net benefits. Alternatives LS-2A through LS-4 did not incorporate height improvements for sea level rise, and thus were not considered further for the final array. The list in Table D does not include alternatives LS-2A through LS-4 for this reason.

2.9.5.3 Real Estate

The study initially based the cost estimate of determining affected real estate parcels on the Sacramento District's levee design criteria for a standard 20-foot landside easement. The cost segments were evaluated on land use types which were orchard, agriculture, residential, or commercial. The sponsor requested an exception to reduce the landside easement to 10-feet for the existing federal

system levees within the project. The smaller easement was granted since alternatives LS-7a, LS-8a, and LS-9a have on average approximately 600 parcels which would likely require a real estate take if the 20-foot easement were required. The 10-foot easement was only adopted for existing federal system levees where the levee toe remains fixed (i.e. levee fix does not require geometry fix or height raise). For federal system levees, when construction of the levee improvement feature requires the landside toe of the levee to shift, then an additional easement of 10 feet is required for construction and O&M. For levees that are not part of the current federal system, 15 feet landward of the toe is the Corps' policy (this is different than the Sacramento District's standard). If the easement on an existing levee whose toe remains fixed is less than 15 feet as stated above, additional easement must be secured. A waterside easement of 15-feet is required regardless of whether the levee is an existing Federal levee or if it is a new non-Federal levee. Securing the waterside easement is expected to be relatively low in cost and was excluded from the parametric estimates. The cost is to be evaluated during refinements to the recommended plan (formerly the TSP) following adoption of the TSP as the recommended plan.

As the Corps refines the selected plan, for new constructed levees the design will include a 15-foot right-of-way (ROW) per the Corps' ETL measured from the levee toe for both water side and land side. It is anticipated that Sacramento District's policy of a 15-foot ROW will officially be the same as the Corps' policy once the refinement of the selected plan begins. Should a seepage berm, stability berm, or other flood feature be required the ROW is measured from the furthest extent of these features.

2.9.5.4 Operation and Maintenance

Operation and maintenance costs were reflective of additional effort by the local managing agency (LMA) to properly maintain new features. The increased level of effort was qualitatively evaluated and assigned a percentage based on increased O&M cross section and best judgment. The LMA's annual budgets were used to prorate costs per length of maintained area and were multiplied by the increased percentage of effort to obtain an annualized O&M cost. Some of the items that were qualitatively evaluated when determining the increased level of effort were the following.

- Inspection area
- Mowing and vegetation control
- Rodent control
- Pumps, valves, and appurtenances
- Provide periodic increases in levee height to address ground subsidence.

Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) values did not include the LMA's existing budgets to maintain levee and flood features. In many cases the project improvements should reduce O&M efforts. However, the PDT determined that additional OMRR&R costs should be factored to account for project features which increased LMA O&M efforts over a 50-year design life. Significant contributors to increased LMA O&M efforts were the closure structures at Smith Canal and Fourteen Mile Slough.

These structures considered gate replacement costs and related mechanical maintenance on supporting systems.

2.9.5.5 Encroachments

Department of Water Resources (DWR) levee logs contributed to most of the utility inventory. Other encroachment information was available as GIS data from the City of Stockton and Nation Levee Database. Up to the selection ofthe final array, areas with limited utility coverage used the unallocated item cost within the PCET tool and leveraged the construction cost contingency for estimating purposes. During refinement of the recommended plan (formerly the TSP), additional data became available and a more complete estimate was created. However, short of conducting a utility survey (which wasn't carried out), the information used to date carries risk with respect to completeness of known utilities and the accuracy of their location. The risk being higher PED costs if utilities aren't listed or inaccurately described.

Utility relocation costs were generated from a series of typical penetration conditions. Most often the fix involved raising pipe(s) invert above the design water surface level through the levee. This typically involved replacing the pipeline and adding positive closure valves to meet Corps EM 1110-2-1913 policy.

Table P. provides information about the most significant utility encroachments and the proposed utility modification for the levees of North and Central Stockton.

Table P. Description, and Ownership of Utility Relocation for North Stockton Levees

Owner	Segment/Levee Mile	Description
City of Stockton	CR_80_R: 21.21	Bianchi & Calaveras River Pump Station: Replace /relocate multiple pipes through the levee.
Univ of Pacific	CR_70_R: 22.11	Cut/replace 8-in concrete pipe 5' below crown
City of Stockton	CR_40_R: 23.77	Replace/relocate 33-in sewer force main
City of Stockton	CR_40_R: 23.77	Brookside & I-5 Pump Sta.: Replace/relocate multiple pipes through levee, 5.5' below crown.
City of Stockton	CR_30_R: 24.23	Replace/relocate 5 Discharge Pipes through levee
East Bay Municipal District	TS_10_L: N/A	Pump Station: Protect 2 pipes through levee
City of Stockton	FM_30_L: N/A	Replace/relocate 30-in sewer force main perpendicular to levee
City of Stockton	FM_40_L: N/A	Cut/replace 30-in sewer force main perpendicular to levee
City of Stockton	FM_60_L: N/A	Cut/replace 66-in sewer pipeline
City of Stockton	MC_20_L: N/A	Cut/replace 54-in storm drain pipe

Table Q. Description and Ownership of Utility Relocation for Central Stockton Levees

Owner	Segment/Levee Mile	Description
Unknown	CR_10_L: N/A	Cut/replace pipe and possibly relocate misc power encroachments
Unknown	SJR_40_R: 0.68	Cut/abandon 3-30-in pipes 22' below the crown
City of Stockton	SJR_40_R:0.7	Cut/replace 60-in RCP sewage outfall
Unknown	SJR_40_R: 0.78	Cut/Replace 42-in pipe 18' below crown
City of Stockton	SJR_50_R: 1.08	Cut/replace 36-in concrete encased pipe through levee 15' below crown
Unknown	SJR_50_R: 1.08	Cut/replace sewage outfall pipe through the levee 12.5' below crown
City of Stockton	SJR_60_R: 1.45	Cut/replace 60-in and 2-25-in conduit lines through levee
Unknown	SJR_60_R: 1.43	Cut/abandon 36-in pipe through levee, 20' below the crown
City of Stockton	SJR_70_R: 1.85	Replace/relocate 4-24-in & 1-8-in pipe plus miscellaneous items
City of Stockton	FCS_10_R: 0.22	Cut/replace 8-in pipe, 2.5' below crown
Unknown	FCS_10_R: 0.78	Cut/Replace 16-in pipe, 12' below the crown
Unknown	FCS_10_R: 1.6	Cut/abandon 18-in pipe through levee, 8' below crown
City of Stockton	FCS_10_R: 1.75	Protect in place 2-42-in & 1-72-in pipe under the levee and under channel
City of Stockton	DC_10_R: N/A	Cut/Replace multiple pipes through levee
Unknown	DC_30_R: N/A	Cut/replace 42-in sewer line

A final determination on compensability will be required for specified relocations prior to execution of the Project Partnership Agreement (between the Corps and the non-Federal sponsors). Impacted utilities/facilities, such as those listed above, do not have a final determination as compensable and non-compensable relocations. A final determination of the relocations necessary and for qualifying compensabilities for the construction of the project will occur during PED.

2.9.5.6 Pre-Construction, Engineering and Design (PED), and Construction Management (CM)

The cost estimates included both PED and CM which were assigned a percentage of the construction, environmental mitigation, and utility relocations. PED was assigned a value of 15% based on historical values. CM was assigned 10% of the costs.

2.9.6 Borrow Sites/Disposal Areas

A maximum of 1.4 million cubic yards (cy) of borrow material and 138 acres of borrow lands could be required to construct the project. Because project development is in the preliminary stages of design, and because of the high rate of turnover of borrow areas over time in the Stockton area, detailed studies of borrow needs are likely to change over a shorter timeframe than would be anticipated in other areas. If the project is authorized and funded, detailed evaluation of borrow requirements, identification and detailed technical evaluation of potential borrow sources would be completed during PED.

Excavated and borrow material will be from within a 25-mile radius and would be stockpiled at staging areas. To the extent feasible, borrow material would be obtained from a licensed, permitted facility that meets all Federal and State standards and requirements. In addition, many acres of farmland and vacant land currently exist near the project and borrow could be obtained from these lands. In selecting borrow areas, lands closest to the construction sites would be evaluated for availability and suitability first before evaluating lands further from the project. Haul trucks, front end loaders, and scrapers would bring borrow materials to the site. The material would then be spread evenly and compacted according to levee design plans. The levee would be hydroseeded once construction was completed.

Over half a million cubic yards of unsuitable soil are expected to be disposed of at commercial and local disposal sites. Additionally, some of this soil can be used to mitigate for the borrow areas and fill in low spots. The estimate is that 50% of the excavated material will be able to be reused.

2.9.7 Construction Access, Haul Routes and Staging Areas

For construction and staging areas the early planning analysis indicates that sufficient sponsor, county, or city property exists and that additional areas do not need to be purchased. These local properties in the form of empty lots, right-of-ways, and easements would be available for these functions. Thus, specific access and staging areas were not identified for the feasibility study. In areas where the sponsor lacked proper access or easement, the real estate estimates included cost to obtain the required easements per paragraph 2.9.5.3 which would also be used for access and staging needed to facilitate construction of the flood risk management features.

During the formation of the alternatives, haul routes were not identified. Haul routes are expected to be fairly direct between the borrow areas and the construction. Multiple borrow areas are expected to be located within 25 miles of the construction, some of which are tied to sponsor interests. It is unclear which borrow areas would continue to be viable until the start of construction, and thus the identifying specific

haul routes will be required during the PED phase.

2.10 Cost Engineering

2.10.1 General

The cost estimates under the study have been prepared under ER 1110-2-1302 Civil Works Cost Engineering which describes levels of detail with respect to cost. The level of detail is based on ASTM E 2516-06, Standard Classification for Cost Estimate Classification System. The Parametric Cost Estimating Tool (PCET) used to parametrically define the initial and final array of alternatives is based on a Class 4 level of detail. The recommended plan is based on a Class 3 level of detail prepared using computer aided cost software (MCACES) and is referred to as the recommended plan in this report.

Real estate estimates were based on footprint requirements for project construction, operation and maintenance provided by Civil Design Section A. Alternative estimates were prepared based on refinements to the preliminary layouts, features, and measures as determined by screening analysis as performed by Planning Division, and input from the potential non-Federal sponsors. Design guidance for cost estimates comes from ER 1110-2-1302, Civil Works Cost Engineering.

2.10.2 Preliminary Cost Analysis (Array of Alternatives)

This section serves as a history of Cost Engineering results for the final array of alternatives leading to the Tentatively Selected Plan (TSP). There are seven alternatives in the final array as listed below. For descriptions of the alternatives, see Section 2.4.4 – Final Array.

The quantities and project cost estimates for the final array of alternatives were prepared by Civil Design utilizing unit costs for typical construction items as developed by the Cost Engineering Section and other cost data furnished by the Environmental Planning and Real Estate sections. A summary of estimates for the final array of alternatives is provided in the cost engineering addendum.

2.10.2.1 Quantity Takeoffs

Quantities for most project items relative to levee construction/modifications were developed by Civil Design Section using a spreadsheet tool. This spreadsheet utilizes generic cross sections with predetermined cost elements (typical levee work such as clearing and grubbing, earth fill, aggregate base, etc). Civil Design provides quantities for those elements based on input of design levee parameters as determined by the Geotechnical Section.

2.10.2.2 General Methodology in Cost Estimate Preparation

During this period of alternatives study leading to the TSP, ER 1110-2-1302 requires Class 4 Cost Estimates as a minimum. Class 4 estimates are primarily stochastic in nature with an expected accuracy range index of 3 to 12 where the value of '3' represents +30/-15 percent and a value of 12

represents a +120/-60 percent range. In developing the class 4 cost estimates for the alternatives, the Cost Engineering team (Cost Engineers and Civil Design Engineers) utilized a number of different methods to determine project costs.

2.10.2.3 Levee Improvement Cost Summary

Generic/parametric/characteristic unit construction costs for many typical levee improvement elements were developed using estimating software MII (MCACES, 2nd Generation). For a typical element such as a slurry wall or borrow material (acquisition and placement), a unit cost was established based on a 'typical' crew, production rate, material cost, assumed/typical haul distance, etc. Davis Bacon labor rates (2014), MII Equipment rates (2011 Equipment Book), current fuel prices (2014) and generic/typical Contractor markups were utilized to establish unit costs. For any particular levee improvement (such as to fix-in-place the levee by degrading, placing a slurry wall/seepage barrier and restoring the levee), the estimating exercise sums the quantities times the unit costs, adds a percentage for such items as mobilization and demobilization, and indicates a total cost per linear foot of levee improvement.

2.10.2.4 Historical Cost Data

Historical unit costs for some items have been utilized based on cost estimates for past projects in the vicinity of Sacramento. For example, pump station costs were based on costs for similar pump stations developed for the Natomas PACR. Cost data was also supplied by other disciplines, specifically Real Estate and Environmental (Mitigation).

2.10.2.5 Cost Engineering Experience

Cost Engineering judgment and experience was used to base some costs on a percentage of construction costs (e.g. Preconstruction Engineering and Design/PED cost, Construction Management cost). The percentages are based on historical data and typical rates used by SPK Cost Engineers in the past.

Each alternative consists of several separable areas divided into reaches/sub-alternatives of various lengths and each reach has an associated type of levee improvement. The sum of all applicable costs for each reach is entered into a spreadsheet that is a compilation of total project costs. The total project cost summaries (first cost) follow the Civil Works Work Breakdown Structure (CWWBS) code of accounts. Feature Codes typically involved in this estimate are 01-Lands and Damages (Real Estate), 02-Relocations, 06-Fish and Wildlife Facilities, 11-Levees and Floodwalls, 18-Cultural Resource Preservation, 30-Preconstruction Engineering and Design, and 31-Construction Management. The 30 and 31 accounts involve any costs associated with USACE staffing on the project for the federal share and anticipated costs associated with local sponsor costs for the non-federal share. The cost estimate for each Alternative is the summation of the costs from the major cost categories. The costs do not account for life cycle costs.

2.10.2.6 Environmental and Cultural Considerations

The Environmental Mitigation cost estimate is performed by SPK Environmental Planning and provided to Cost Engineering. Since this is a construction cost the contingency applied to this account is the effective contingency derived from the Cost and Schedule Risk Analysis.

Mitigation costs were estimated based on acreages of habitat types impacted per the requirements of the Biological Opinions. Each habitat type's costs were assessed considering onsite mitigation and offsite mitigation. For habitat mitigation, a habitat evaluation was preformed to assess the quality of the existing habitat compared to an estimate of the future with project condition. The results of the habitat evaluation was applied to a cost effectiveness/incremental cost analysis to determine the most cost effective mitigation alternatives for the Government. Mitigation is proposed in quantities ranging from in-kind, to a 2 to 1 ratio or 3 to 1 ratio. Larger quantities of mitigation are only proposed when required by the terms and conditions of the Biological Opinions.

On-site mitigation is preferred because it provides higher habitat compensation values than off-site mitigation because the restoration activities occur on the same area as the area of the impact, and was used to the extent practicable. On-site mitigation costs were coordinated with the Corps' landscape architecture department and were based on past experience for implementation of these types of sites in the area. Additional consideration went into the feasibility of whether or not on-site mitigation was practicable for the impacted habitat type. The cost for offsite mitigation is based on the acreage required multiplied by a standard rate for buying credits from a local mitigation bank.

The Cultural Resources Mitigation cost estimate is performed by SPK Cultural Resources and provided to Cost Engineering. Since this is a construction cost, the effective contingency is derived from the Cost and Schedule Risk Analysis. Mitigation costs were initially set at 1% of the project cost; this has since been revised during the comment period. Revised mitigation costs were estimated based on the size of the proposed project, the number of known cultural resources sites within a portion of the project area, the diversity of site types, and costs for mitigation on other SPK Civil Works Projects of similar scales. Importantly, mitigation costs are a component of the broader compliance process undertaken by SPK, and should not be seen as the total cost of compliance activities.

2.10.2.7 OMRR&R Costs

For a description of how the O&M costs were derived, refer to section 2.9.5.4. Table R(a). provides the annual cost of OMRR&R for each alternative.

Table R(a). Annual LSJ OMRR&R Costs

OMRR&R COSTS		
Alternative	**OMRR&R Annual Cost**	**OMRR&R Lifespan Cost (50 yr)**
7a	$274,800	$13,740,000
7b	$386,700	$19,335,000
8a	$296,600	$14,830,000
8b	$408,500	$20,425,000
9a	$344,800	$17,240,000
9b	$456,700	$22,835,000

2.10.2.8 Total Project Schedule (including Construction)

A formal construction schedule has been developed and the assumption is that the yearly federal monetary allotment for the project will be approximately $100M over 15 ½ years. The initial PED portion of the project is assumed to take about 2 years. The original total duration for construction completion for each alternative in the final array is provided in the following table recognizing that these are pre-recommended plan approximations:

APPROXIMATE DURATION	
Alternative	**Years**
7a	12
7b	15
8a	12
8b	15
9a	12
9b	15

2.10.2.9 Cost Uncertainties & Risk Analysis

There are inherent uncertainties in the costs at this level of design (alternatives analysis) since there is no detailed design, plans or specs. There are also inherent uncertainties as the construction contractor(s) are responsible for obtaining the construction materials, accomplishing the work in a timely manner as per the project due date, using overtime and/or multiple crews to accomplish the same, etc. Funding appropriations are typically uncertain. The Central Valley of California is home to many threatened/endangered species that require much of the work to be done within certain construction windows, typically May-October.

For this project, more than 50% of the costs for this project are directly related to levee improvements. A large percentage of this is obtaining and hauling materials for placement of levee fill or impervious fill material (clay cap). For the purposes of the cost estimate, the assumption has been made that stone material will be placed from the landside (trucked). Stone materials are expected to come from either the Bay Area or the Sierra Nevada mountains.

Much of the existing levee material can be re-used but still must be hauled to/from stockpiles. Impervious fill is assumed to come from within 25 miles (one-way haul). The potential contractors are free to obtain local borrow material that meets the intended specifications. Haul costs in general have some uncertainty as material supply locations are up to the contractor, as well as whether the contractor uses their own trucks or utilizes independent truckers for hauling. Another work feature of high risk/high cost is the seismic strengthening of levees which use deep soil mixing (DSM), which requires significant placement time.

An Abbreviated Cost Risk Analysis (ACRA) using the Cost MCX Abbreviated Risk Analysis Template (spreadsheet) was performed for each of the final array of alternatives. The alternative was divided into its main component areas (e.g. North Stockton, Central Stockton, and RD17) and risks were assessed relative to each area. The summary sheet for each alternative ACRA is provided in the Cost Engineering Addendum.

The ACRA meeting was held 4 NOV 2013 with the project manager and most PDT members. The meeting focused primarily on risk identification using the CRA template and brainstorming techniques. The risk analysis process involved dividing project costs into typical risk elements and placing them into a Risk Register, then identifying the risks/concerns relative to those risk elements, and then justifying the likelihood of the risk occurring and the impact if the risk occurs. A Risk Matrix utilizing weighted likelihood/impacts is used to establish the cost contingency to use for each risk element (work feature) for use in alternatives comparisons. Project risks were identified and the risk register developed within the spreadsheet for the component areas of each alternative. The likelihood of an impact on each risk element was assessed by the PDT. The draft risk register and results were then forwarded to the PDT for review.

Risk elements were identified for each alternative based on the Civil Works Work Breakdowns Structure (CWWBS) and work feature. Prime construction work features identified were Earthwork, Cutoff Walls, DSM walls (Seismic), and Slope/Erosion Protection, These items typically accounted for 80 percent or more of the costs, except for the Central Stockton area, where there are several diversion structures and bridges that are, with remaining construction features such as mob/demob, relocations, and hydroseeding, lumped together in a category for 'Remaining Construction Items.' The risk register thus serves the purpose of historical documenting as well as to support follow-on risk studies as the project and its accompanying risks evolve. The results of the ACRA therefore reflect the risk register parameters and are considered adequate for establishing contingencies for alternatives comparison.

To fully recognize its benefits, risk analysis must be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, budgeting and scheduling.

2.10.2.10 Screening Level Costs

The costs provided are considered parametrically based and are not refined and are to be used to compare the relative cost between the Alternatives. Focus on the Cost Engineering data has been on the alternatives. Once the PDT has selected the recommended plan (formerly the TSP) and any locally preferred plan (if different from the TSP), Feasibility Level design details and quantities by Civil Design, and Cost Engineering data, must be developed. This includes creation of refined plans in order to update the associated quantities, development of a detailed MII estimate, a Total Project Schedule (including Construction), PDT estimates for Planning, Engineering and Design, an updated Cost and Schedule Risk Analysis and a Total Project Cost Summary (TPCS) extending costs out through the life of the Project. The MII estimate must be detailed indicating labor, equipment and materials with accompanying production rates.

2.10.2.11 Key Assumptions (on Cost Estimates for Alternatives)

2.10.2.11.1 Quantities and Parametric Cost Estimates

The parametric templates (cross sections) for the various levee improvements, or new levees, are representative of levee reaches. Where the design is insufficient to produce detailed quantities for each reach, the use of these typical cross-sections represents quantities adequate to screen alternatives to the point of determining a selected plan. Unit costs utilized are fair and reasonable.

2.10.2.11.2 Haul Distances

Levee Fill Borrow will come from within 25 miles (one-way haul).

2.10.2.11.3 Project Schedule

For purposes of this study, an annual appropriation of 100 million dollars (federal) was anticipated along with the Non-Federal Sponsor's schedule for acquiring rights-of-way. Ultimately, the recommended plan would be constructed in seven reaches over a 14-year period, with project schedule dependent upon the M2 estimate.

2.10.2.11.4 Real Estate

Real Estate Costs are reasonable.

2.10.2.11.5 Environmental Mitigation

Costs provided by the Environmental Specialists in Planning are reasonable.

2.10.2.11.6 PED Costs

A value of 15% of the Federal Share Construction Costs & 15% of Non-

Federal Construction Costs are consistent with those used in recent years for feasibility studies performed by the Sacramento District.

2.10.2.11.7 Construction Management Costs

A value of 10% of Federal Share Construction Costs & 10% of Non-Federal Construction Costs are consistent with those used in recent years for feasibility studies performed by the Sacramento District.

2.10.3 COST ENGINEERING FOR THE RECOMMENDED PLAN

2.10.3.1 BASIS OF ESTIMATE

This section relates general Cost Engineering data for the Recommended Plan (TRP, previously Alternative 7A). For more detail, see the Cost Engineering Addendum.

This estimate is based on the final feasibility report:

San Joaquin River Basin
Lower San Joaquin River, CA
Final Integrated Interim Feasibility Report
September 2017

For preparing a Feasibility Level cost of the recommended plan, ER 1110-2-1302 requires Class 3 Cost Estimates as a minimum. Class 3 estimates are primarily stochastic in nature. In general, the unit costs for the construction features are computed by estimating the equipment, labor, material, required and the production rates suitable for the project features. The baseline feasibility cost estimate was developed from quantity take-off calculations provided by the Sacramento District's Civil Design Section. Levee alignments were provided to Cost Engineering as Google Earth files. No detailed plans/drawings were developed. Supplementary drawings of certain items such as floodwalls were developed to provide some clarity for cost estimating and review.

Due to the large scope, the project is broken into construction contracts by reach. Each reach is assumed to be a separate contract. The type of solicitation is expected to be unrestricted IFB.

2.10.3.2 PROJECT SCOPE/DESCRIPTION

The project provides for flood risk reduction near and around the city of Stockton, CA and consists primarily of the construction of in-place levee improvement measures to address erosion protection and slope stability, seepage, and overtopping (height) concerns. Flood risk management will also be aided by constructing and operating closure structures on Fourteenmile Slough and Smith Canal. Below is a brief description of the design remediation methods.

Erosion protection and slope stability are improved by placing rock

revetment on the waterside of the levee. The rivers, creeks and sloughs are too shallow for barges and placement will be from the land side.
The levee remediation to address seepage is provided through cutoff walls, by degrading the levee and then constructing a cutoff wall utilizing soil-bentonite slurry walls. Cutoff walls are typically through the centerline of the levee. In one reach, a new levee will be constructed, offset from the existing levee. Part of this new levee will utilize deep-soil-mixing (DSM). A grid pattern of DSM walls will provide seismic stability for the levee that overtops it. At one of the crossings of Interstate 5, relief wells are used where the top of levee is below the I-5 bridge deck.

Height improvements to address overtopping concerns include levee raising and new floodwalls or height improvements to existing floodwalls.
Along the levees, there are utilities that need to be relocated or removed. Active utilities such as pressure pipes, irrigation pipes, drainage pipes, electrical, sewer, gas, cable and water lines are to be removed and replaced in order to construct the cutoff walls. Temporary utilities service is to be provided during the service outages. Roads or bike paths on the levee crowns that must be removed in order to demolish or relocate utilities will be replaced. In a few locations, the utilities are of such a size or depth that it is considered to be impractical to provide temporary utility services and at these locations jet grouting is assumed in lieu of cutoff walls.

2.10.3.3 ENVIRONMENTAL AND CULTURAL RESOURCES (UPDATE FROM STUDY OF ALTERNATIVES FOR SELECTION OF TSP)

Mitigation costs were estimated based on acreages of habitat types impacted per the requirements of the Biological Opinions. Each habitat type's costs were assessed considering onsite mitigation and offsite mitigation. For habitat mitigation, a habitat evaluation was performed to assess the quality of the existing habitat compared to an estimate of the future with project condition. The results of the habitat evaluation was applied to a cost effectiveness/incremental cost analysis to determine the most cost effective mitigation alternatives for the Government. Mitigation is proposed in quantities ranging from in-kind, to a 2 to 1 ratio or 3 to 1 ratio. Larger quantities of mitigation are only proposed when required by the terms and conditions of the Biological Opinions.

On-site mitigation is preferred because it provides higher habitat compensation values than off-site mitigation because the restoration activities occur on the same area as the area of the impact, and was used to the extent practicable. On-site mitigation costs were coordinated with the Corps' landscape architecture department and were based on past experience for implementation of these types of sites in the area. Additional consideration went into the feasibility of whether or not on-site mitigation was practicable for the impacted habitat type. The cost for offsite mitigation is based on the acreage required multiplied by a standard rate for buying credits from a local mitigation bank.

The Cultural Resources Mitigation cost estimate is performed by SPK

Cultural Resources and provided to Cost Engineering. Since this is a construction cost, the effective contingency is derived from the Cost and Schedule Risk Analysis. Mitigation costs were initially set at 1% of the project cost; this has since been revised during the comment period. Revised mitigation costs were estimated based on the size of the proposed project, the number of known cultural resources sites within a portion of the project area, the diversity of site types, and costs for mitigation on other SPK Civil Works Projects of similar scales. Importantly, mitigation costs are a component of the broader compliance process undertaken by SPK, and should not be seen as the total cost of compliance activities.

2.10.3.4 OMRR&R UPDATE

For a description of how the original O&M costs were derived, refer to section 2.10.2.7. Table R(a) provides the annual cost of OMRR&R for the recommended alternative based on a 50 year design life. This accounts for subsidence of the non-federal levees with the assumption of a 2 FT high floodwall constructed at the end of 25 years (over 46,800 LF of levee).

Table R(b). Annual LSJ OMRR&R Costs and OMRR& Lifespan Costs

Item	OMRR&R Annual Costs	OMRR&R Life-Span Cost (50 yr)
Recommended Plan	$274,800	$13,740,000
Subsidence (Floodwall built after 25 years)	$1,072,800	$107,280,000

2.10.3.5 MII COST ESTIMATE - NOTES & ASSUMPTIONS

The MII (MCACES, 2nd generation) Cost Estimate is divided into reaches, with each reach assumed to be a separate construction contract. See the Cost Engineering Addendum for summary costs from the MII estimates.

PROJECT SCOPE/DESCRIPTION

The recommended plan has been divided into five levee reaches (typically 4-6 MI long) and two control structures (one at Fourteenmile Slough and one at the Smith Canal). The description of each reach, and typical work involved for each, is as follows:

North Stockton Area

1-North Stockton: Mosher Slough (LB), Stuart Tract (RB), Fivemile Slough (RB)
2-Delta Front: Fourteenmile Slough (LB), Tenmile Slough (LB), San Joaquin River (RB)
3-Fourteenmile Slough Closure Structure
4-Calaveras River (RB)

Central Stockton Area

5-Calaveras River (LB) and San Joaquin River (RB, North Port)
6-Smith Canal Control Structure
7-RD 404 and Duck Creek: San Joaquin River (RB), French Camp Slough (RB), Duck Creek (RB).

ACQUISITION PLAN

The type of solicitation is expected to be unrestricted IFB. All the levee reaches are fairly long with most having several road/highway/interstate crossings and many utility relocations, several for large pipes. The work for any individual reach can probably be performed in one or two construction season, except for the Delta Front. Large business is assumed throughout.

CONTRACTING PLAN

For each reach, the prime contractor expected to be an earthwork contractor responsible for the general site work, borrow site excavation, levee degrading and rebuilding to the restored or new levee height, and bank stabilization. Miscellaneous/General Subcontractors are expected to be utilized for cutoff walls, jet grouting, hydroseeding, and vibration monitoring.

CONSTRUCTION WINDOWS

The total project schedule for this estimate breaks construction for large reaches into seasons based on construction work windows. The construction work window for major Levee Improvement and Relocations construction activities is typically May-Oct, April and November are available for mobilization and demobilization of equipment and non-flood protection items such as hydroseeding that do not change the effectiveness of flood control and drainage system.

OVERTIME

Overtime is included in this estimate. Assumption is 10 hr days, 6 days/week.
TOTAL PROJECT SCHEDULE

The Total Project Schedule including design, pre-construction and construction were developed using MS Project with construction durations based on those developed in MII. These are used to insure the project reaches could, in general, be completed within the construction windows and with the anticipated crews. The Construction Period is 14 years and includes PED. See the Cost Engineering Addendum for the schedule.

BORROW \ DISPOSAL AREAS

The local sponsors have identified three potential Soil Borrow areas, and the furthest is assumed as the general location for borrow. In general, it is about 10-20 MI (one way) to the various reaches. It is uncertain whether all borrow can be obtained from these sites at the time of construction, so some borrow may need to be obtained from local suppliers or by development of new borrow sites by the Contractor. This was considered during the Cost and

Schedule Risk Analysis (see below) and considered low risk. The Sponsor has confirmed that suitable borrow material is available within 25 miles. The assumed landfill is the North County Landfill (San Joaquin County). The haul distance is 15-25 MI (one way), dependent on the reach segment location.

Certain companies in the Stockton area receive such items as green waste, broken concrete, and excavation that may not be satisfactory for reuse in levees, etc. The typical haul distance to these areas is about 10-20 MI (one way).

CONSTRUCTION METHODOLOGY

The construction methodologies are considered standard for most construction work. One exception to standard construction is jet grouting around deep utilities.

UNUSUAL CONDITIONS

Construction of the Control Structures such as those proposed for the project has not been done in the area for many years. Construction may be tidally influenced.

Night work is anticipated at the I-5 road crossings.

UNIQUE TECHNIQUES OF CONSTRUCTION

Deep Soil Mixing and Jet Grouting are considered unique in that relatively few contractors perform this work.

EQUIPMENT AND LABOR AVAILABILITY & DISTANCE TRAVELED

In an urban area such as Stockton and Sacramento (less than 50 MI away), equipment and labor is readily available. Deep Soil Mixing and Jet Grouting rigs are available, but in limited number, and there is a great deal of levee improvement work anticipated in the California Central Valley for the next 10 years or more. For this reason, it is assumed than no more than three DSM rigs are used within any construction reach. The TOTAL PROJECT SCHEDULE reflects this.

LABOR RATES, EQUIPMENT RATES, MATERIAL & FUEL COSTS & SALES TAX

This estimate meets Davis Bacon wage rates for Davis Bacon wage determinations for the state of California as of September 2017. Equipment unit costs were obtained from historical Quotes or verbal/telephone conversations with Contractors performing like or similar work and the MII/MCACES Equipment Library 2016, Region VII.
Note: Fuel prices are October 2017 using 5 year average of fuel costs for CA from http://www.eia.gov/petroleum/gasdiesel/. Off-road diesel costs are not subject to state and federal excise taxes, so those taxes are removed from off-

road diesel prices.

2.10.3.6 COST AND SCHEDULE RISK ANALYSIS

The scope of the risk analysis was to calculate and present the cost and schedule contingencies at the 80 percent confidence level using the risk analysis processes, as mandated by U.S. Army Corps of Engineers (USACE) Engineer Regulation (ER) 1110-2-1150, Engineering and Design for Civil Works, ER 1110-2-1302, Civil Works Cost Engineering, and Engineer Technical Letter 1110-2-573, Construction Cost Estimating Guide for Civil Works. The study does not include consideration for operation and maintenance or life cycle costs. For further information see the Cost Engineering Addendum.

2.10.3.7 TOTAL PROJECT COST SUMMARY

See the Cost Engineering Addendum for the certified Total Project Cost Summary (TPCS). First Costs are based on 1 Oct 2017 price levels. Fully funded costs are first costs escalated to the midpoint of design or construction (as per the anticipated construction schedule).

REAL ESTATE (01 Account)

The Real Estate cost estimate (01 Account Lands & Damages and Administrative costs) is performed by the SPK Real Estate Division and provided to the Cost Engineering section. The 01 Account Lands and Damages, Relocation Assistance Payment, and New Utility Easements cost estimates were appraised (please refer to the Real Estate Plan for more detail). These technical Real Estate increments estimated by the appraiser are independent of the contingency derived though the Cost and Schedule Risk Analysis (CSRA). The contingencies were provided by the Real Estate Division.

RELOCATIONS (02 Account)
Construction costs for relocation of utilities and roads were developed primarily through the use of MII. Contingency applied to this account is the effective contingency derived from the Cost and Schedule Risk Analysis.

FISH & WILDLIFE FACILITIES - ENVIRONMENTAL MITIGATION (06 Account)

The Environmental Mitigation cost estimate was performed by SPK Environmental Planning and provided to Cost Engineering. Since this is a construction cost the contingency applied to this account is the effective contingency derived from the Cost and Schedule Risk Analysis.

LEVEES AND FLOODWALLS (including erosion protection) (11 Account)

Construction costs for these accounts were developed using MII. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

FLOODWAY CONTROL AND DIVERSION STRUCTURES (15 Account)

Construction costs for these accounts were developed using MII. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

PLANNING, ENGINEERING AND DESIGN (30 Account)
The cost for Planning, Engineering and Design (PED) is assumed as 17.6% of the Construction Estimate Total, based on historical estimates done by SPK. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

For this project, the assumed percentages are as follows:

Project Management	1.60%
Planning & Environmental Compliance	2.14%
Engineering and Design	8.20%
Review, ATRs, IEPRs, VE	0.30%
Life Cycle Cost Updates (costs, schedule, risks)	0.70%
Contracting & Reprographics	1.00%
Engineering During Construction	2.00%
Planning During Construction	0.30%
Project Operations	1.30%

CONSTRUCTION MANAGEMENT (31 Account)
The cost for Construction Management (CM) is assumed as 10% of the Construction Estimate Total, based on historical estimates done by SPK. Contingency applied is the effective contingency derived from the Cost and Schedule Risk Analysis.

For this project, the assumed percentages are as follows:

Construction Management	7.00%
Project Operations	1.30%
Project Management	1.70%

2.11 Value Engineering

A Value Engineering Study was performed on the preliminary alternatives for this project in July 2013 with the final report date of 19 August 2013.

The objectives of the VE study were to validate, refine and optimize alternatives; facilitate communication; and improve value (increase performance and/or reduce cost). By meeting the objectives, the VE study was able to begin the process of identifying a final array of alternatives. The VE study introduced Value Metrics which analyzed cost and performance in order to calculate a project value. By the end of the VE study the effort had identified a draft final array which eventually led to the final array provided in Section 2.4.4 and Table D.

2.12 Environmental Engineering

Engineering Regulation (ER) 1165-2-132, HTRW Guidance for Civil Works Projects requires that a site investigation be conducted to identify and evaluate existing and potential HTRW issues. This HTRW Site Summary report was conducted in accordance with ER 1165-2-132 and ASTM 1526-05, Phase I ESA as a supplemental guidance. Regulatory database search reports and regulatory agencies' websites were reviewed and assessed for HTRW sites in the Study Area, along the 40 miles long levees proposed for new levee construction, modification and upgrades to the existing levees.

The Study Area for this report is defined as an area 40 miles wide along the proposed levees identified for the alternatives. The Lower Mormon Slough section was a separate study and was conducted as a Phase I Environmental Site Assessment (ESA) and was completed in March 2014.

The Phase 1 report provides the data as being reasonably accurate as of May 2014. The status of HTRW sites are constantly changing and new HTRW sites may be added to the regulatory databases over time. Currently unknown HTRW sites may also be located within the study area and would not be included in this report.

The Phase 1 report lists over 100 sites which are located within 0.25 miles of the LSJ proposed levees. The proposed project alternatives share all of the known sites except for seven active/closed sites located near the Calaveras and the Stockton Diverting Canal (LS-8a). An assessment was made of the Phase 1 report list for sites located within approximately 900 feet of the Calaveras/Stockton Diverting Canal portion of the 8a levees which are presented in Table S. below.

Table S. Active and Closed Hazardous Waste Sites Specific to Alternative LS-7a and the Potential for Levee Site Clean-Up as Low, Medium, or Possible During Construction

Site	Possible Contaminant	Distance to Levee (ft)	Active or Closed Site	Potential for Levee Clean-up
Brea Ag Service 1905 N. Broadway	Pesticide, fertilizer, gw contamination	~ 250-ft	Unknown	Possible
Colon Property 5681 E. Marsh Rd.	Junkyard, possible lead in soil	~ 350-ft	Active	Medium
Beacon Property #27 3300 Waterloo Rd.	Gasoline contamination	~ 650-ft	Closed Site	Low
Fisco Warehouse 1648 Shaw Rd.	Diesel contamination	~ 900-ft	Closed Site	Low
Don's Buggy Shop 3245 Wilson Way N	Gasoline contamination	~ 800-ft	Closed Site	Low
Certified Grocers of California 1990 Piccoli St N	Diesel contamination	~ 900-ft	Closed Site	Low
PG&E (Case #2) 4040 West Ln N	Gasoline contamination	~ 900-ft	Closed Site	Low

HTRW clean-up costs for CERCLA-regulated substances (including pesticides and lead) would not be considered project costs. There is a low probability of having significant impacts from contaminated soil based on the information provided in the Phase 1 report and from the results in Table S. Any impacts associated with HTRW for LS-7a are anticipated to be negligible compared to the overall cost of construction. Alternative LS-9 includes the Mormon Channel bypass which was not included in the Phase 1 assessment described above. However, a Phase 1 assessment was provided for Mormon Channel early in 2014. The report highlights multiple locations of surface and subsurface waste along the banks and within the channel. Surface debris characterized in the report can be removed and disposed of properly without much incidence. What is unknown is the extent of the subsurface waste due to the surface waste which is noted. More consideration should be given by the sponsor to understanding the effort relative to the LS-9 HTRW issue if LS-9 is selected as the recommended plan.

Should unanticipated clean-up become necessary, the effort would be considered CERCLA-regulated and a 100% non-Federal cost. The first two entries in Table S are the highest risks associated with alternatives LS-7 and LS-9. The first two entries are sites that are closest to the Stockton Diverting Canal. Should the recommended plan (formerly the TSP) not include the Stockton Diverting Canal in formulation, then most, if not all known clean-up risk can be excluded as a necessary remediation prior to project implementation.

CHAPTER 3 –RECOMMEDED PLAN LS-7a

3.1 General

The proposed alternative is meant to improve the existing levee system and reduce flood risk for the Central and North Stockton areas.

At the agency decision milestone meeting (ADM) held October 5, 2015, the Corps of Engineers made the decision to adopt the TSP and to refine specific features of the project. The refinements included specific design features that hadn't been identified during the tentative selection of the plan. These refinements included specific design features such as cutoff walls, erosion protection, and some new levee along Duck Creek which hadn't yet been identified during the alternative selection process (such as in Table A, B, and C). During the creation of the array of alternatives the PDT team understood that some of the existing levees lacked proper geometric standards, but the team hadn't studied or identified which levees required reshaping. The refinements for all the project features would allow the Corps to derive a better estimate for the cost of designing and constructing the project.

Alternative LS-7a is identified as the recommended plan with higher net benefits than LS-8a and LS-9a. LS-7a is compliant with Executive Order (EO) 11988 which removes RD17 from the study area and therefore is not in conflict with the EO guidance. The EO requires federal agencies to avoid long and short term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practical alternative. LS-7a has a project length of 22 ½ miles and includes geometric improvements to existing levees, cutoff walls, seismic fixes, erosion protection, a control structure, and approximately 1 mile of new levee along Duck Creek. The extent of the project is shown in Figure 15. The history of how LS-7a came about is described in Chapter 2 and specific "a" and "b" designations are described in Table D in Chapter
2. In addition, LS-7a accommodates for height deficiencies due to future sea level rise.

The project includes fixes and new levee along the following tributaries.

- French Camp Slough
- Duck Creek
- Mosher Creek
- Shima Tract
- Five Mile Creek
- Fourteen Mile Slough
- Ten Mile Slough
- Calaveras River

3.1.1 Feature Description – LS-7a

This section provides feature descriptions for Alternative LS-7a. The main features of LS-7a are the North and Central Stockton levee improvements.

All of the individual levee segments that make up LS-7a required either geometric fixes to attain Corps standards and/or a structural improvement was necessary due to through-seepage, underseepage, or seismic deficiencies. These features are described in more detail 3.1.1.1 and 3.1.1.2 below and are captured in Table V.

3.1.1.1 North Stockton Feature

The North Stockton feature length is 13.3 miles requiring 12.3 miles of cutoff wall. A cutoff wall is needed to reduce through and under-seepage. A little less than half of Ten Mile Slough did not require a cutoff wall. Reference Figures 2, 3 and 15 for this information and for other information on the North Stockton area below.

A seismic fix is required for 1 mile of levee in North Stockton. Most of California is under threat of seismic activity and these particular segments are under hydraulic loading for portions of the day which increases the risk of failure during a seismic event. Two sections of Ten Mile Slough require a seismic fix (TS_10L, TS_20L). A setback levee for segment FM_30L provides an opportunity for environmental mitigation for the project. The setback distance will be refined in PED but initial estimates are approximately 100 feet. The existing levee will be degraded to an optimum height that could allow for waters from the slough to inundate these areas and provide valuable riparian habitat to the area. The slough is tidally controlled and when combined with the closure structure it is estimated that the setback will have negligible affects to the hydraulic conditions in the area.

For North Stockton a seepage berm was not recommended due to the higher cost of implementing a seepage berm relative to a cutoff wall. Due to the density of housing and other infrastructure the lack of available real estate precluded the use of seepage berms in the area. A recommendation for a new levee alignment was also not a suggested part of the plan but may be considered in PED to reduce impacts.

Levee geometry improvements are required for 4 miles of the North Stockton levee system. Geometric fixes would be required on Fourteen Mile Slough, the Calaveras River and Ten Mile Slough. Affected segments are FM_30L, FM_60L, TS_10L, TS_20L, and TS_30L.

Erosion protection improvements are required for nearly 5 miles of levee along Fourteen Mile Slough, Five Mile Slough, Shima Tract, and Ten Mile Slough. These segments are located adjacent to lands and waterways which have large fetches allowing wave formation. This erosion protection is needed to reduce wind and wave loading from the delta side during large storm events. The affected segments are FM_30L, FM_40L, FM_60L, FS_10R, ST_10R, ST_20R, TS_20L and TS_30L.

Table T. Details of the Recommended Plan – Alternative 7

BASIN/ CONSTRUCTION CONTRACT	SEGMENT	LENGTH	EXISTING LEVEE SYSTEM[1]	RECOMMENDED IMPROVEMENTS	WIND-WAVE EROSION PROTECTION[2]	RAISE (ft)[2]
NORTH STOCKTON						
CALAVERAS RIGHT BANK LEVEES	CR_10_R	2300	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	CR_20_R	1300	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_30_R	3800	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_40_R	2300	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_50_R	6900	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_60_R	1400	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	CR_70_R	1800	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	CR_80_R	3200	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
DELTA FRONT LEVEES	FM_30_L	7000	NON-FED	-SETBACK LEVEE W/50-FT CUTOFF WALL	YES	-
	FM_40_L	1500	NON-FED	HEIGHT IMPROVEMENTS W/50-FT CUTOFF WALL	YES	1.8
	FM_60_L	1600	NON-FED	HEIGHT AND GEOMETRY IMPROVEMENTS W/50-FT CUTOFF WALL	YES	2.7
	TS_10_L	4000	FEDERAL	SEISMIC W/GEOMETRY IMPROVEMENTS	-	-
	TS_20_L	1600	FEDERAL	SEISMIC W/GEOMETRY IMPROVEMENTS	YES	-
	TS_30_L	5900	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL AND GEOMETRY IMPROVEMENTS	YES	-
FOURTEEN MILE CLOSURE STRUCTURE	FM_50_L	300	NON-FED	CONTROL STRUCTURE W/50-FT MITER GATES	-	-
NORTH STOCKTON LEVEES	FS_10_R	1700	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL	YES	-
	MC_10_L	6600	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL AND HEIGHT IMPROVEMENTS	-	1.4
	MC_20_L	4100	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL AND HEIGHT IMPROVEMENTS	-	1.6
	ST_10_R	2600	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL	YES	-
	ST_20_R	4100	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL	YES	-
CENTRAL STOCKTON						
CALAVERAS LEFT BANK LEVEES	CR_10_L	1700	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_20_L	4300	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_30_L	2300	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	CR_40_L	6900	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL AND GEOMETRY IMPROVEMENTS	-	-
	CR_50_L	1700	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	CR_60_L	1600	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	CR_70_L	3200	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-

Table T. Details of the Recommended Plan – Alternative 7 (cont'd)

BASIN/ CONSTRUCTION CONTRACT	SEGMENT	LENGTH	EXISTING LEVEE SYSTEM[1]	RECOMMENDED IMPROVEMENTS	WIND-WAVE EROSION PROTECTION[2]	RAISE (ft)[2]
	SJR_10_R	2800	NON-FED	FIX IN-PLACE W/50-FT CUTOFF WALL AND HEIGHT IMPROVEMENTS	-	1.8
SMITH CANAL CLOSURE STRUCTURE/ IMPROVEMENTS	SC_30	800	NON-FED	CONTROL STRUCTURE W/50-FT MITER GATES	-	-
	SJR_20_R	2200	NON-FED	SHEETPILE WALL OR RETENTION WALL	-	-
RD 404 LEVEES	SJR_30_R	3500	NON-FED	FIX IN-PLACE W/20-FT CUTOFF WALL AND GEOMETRY IMPROVEMENTS	-	-
	SJR_40_R	4400	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	SJR_50_R	2000	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	SJR_60_R	2100	FEDERAL	FIX IN-PLACE W/20-FT CUTOFF WALL	-	-
	SJR_70_R	4100	FEDERAL	FIX IN-PLACE W/50-FT CUTOFF WALL	-	-
	FCS_10_R	9800	FEDERAL	FIX IN-PLACE W/70-FT CUTOFF WALL	-	-
	DC_10_R	500	FEDERAL	FIX IN-PLACE W/70-FT CUTOFF WALL	-	-
	DC_20_R	2500	NON-FED	NEW LEVEE W/50-FT CUTOFF WALL	-	-
	DC_30_R	1500	NON-FED	New Levee	-	4

Additionally, the project proposes to replace any existing erosion protection (waterside) that gets removed as a result of the fix in-place construction features.

A refinement to the levee improvement in North Stockton was made in the final feasibility design. Reach MC_30_L on Mosher Slough was not included in the recommended plan because it does not meet the minimum flow requirements to establish federal interest. The reach specifics are provided in Figure 15. Minimum requirements of 800 cfs for a 10% (1/10) ACE event and 1800 cfs for a 1% (1/100) ACE event are required to establish Federal Flood Control Authority in CFR 238.7(a).

One control structure has been identified as being necessary at Fourteen Mile Slough for high flow events. This structure would have gates to control water levels on Lincoln and Brookside Village levees. The operation and frequency of the gates will be defined during PED phase, but are expected to remain open normally. Pumping capability is not required for this structure to evacuate interior flood water during events. The probability of a coincident storm and a large high tide event are rare and much of the drainage basin has interior flood detention systems to mitigate the excess waters.

The levees throughout the Stockton area have sporadic areas of vegetation growing on the side slopes and within the easements. Per Corps policy, ETL 1110-2-583 (ETL) requires the clearing of vegetation along the waterside and landside slope and within 15-feet from the waterside toe and 10-feet from the landside toe for existing federal system levees, and up to 15-feet from the

waterside and landside toe for non-federal and new levees. The Corps' informal consultation with Federal and State resource agencies leads the Corps to believe that the LSJR Basin Feasbility Study will receive a jeopardy opinion should the Corps adopt the policy set forth in the ETL.

The Corps has concluded that with the support of the sponsor, a variance will be sought for all non-threatening vegetation for the Mosher Slough, Shema Tract, Five Mile Slough and Fourteen Mile Slough levees. A variance is perceived as the most acceptable solution environmentally, but must retain accessibility for maintenance, inspection, monitoring, and flood fighting.

3.1.1.2 Central Stockton Feature

Central Stockton features total 9.2 miles of improvements, all of which include cutoff wall. Reference Figure 2, 3, and 4 for this information and for other information on the Central Stockton area below.

Levee geometry improvements are required for 2 miles of the Central Stockton levee system. Geometric fixes would be required for one levee segment of the Calaveras River and one levee segment of the San Joaquin River. Affected segments are CR_40L, and SJR_30R. Segment SJR_10_R would require height improvements for sea level raise. Levees improvements along Duck Creek are necessary as a result of not improving the RD-17 levee system. These improvements help prevent flanking of the existing levees by high water from the Lower San Joaquin River. The Duck Creek levee segments are DC_20R, and DC_30R, extending to El Dorado Road.

A refinement to the levee improvement in North Stockton was made in the final feasibility design and includes the addition of CR_70_L as part of the recommended plan. This reach was added to the recommended plan to be consistent with the left bank improvements and to meet the intended performance of that particular reach of the Calaveras River. The addition of this reach is noted in Figure 15 at the end of the report.

A control structure is required at Smith Canal at high flow events to keep both banks of Smith Canal from overtopping. The structure would have gates that will remain normally open and close during higher water events. Pumping capability is not a required feature for the reasons given under the Fourteen Mile Slough closure structure.

In the Central Stockton area the locals are considering providing a letter of intent (LOI) for a SWIF or variance for most of the existing levees. This approach includes most of the south bank of the Calaveras River and the north bank of the San Joaquin and French Camp Slough levees. The exception is the Calaveras River segment CR_10_L, the San Joaquin River segment SJR_10_R and SJR_30_R, and Duck Creek segments DC_20_R and DC_30_R. For these segments the sponsor will be seeking a variance.

The above information on a variance is without formal consultation which could lead to further updates. Between the publication of this document and the beginning of PED further guidance could be provided by the Corps for vegetation on levees.

3.2 Estimated Costs

The cost estimate of the recommended plan is based on MII.

3.2.1 Total Cost for LS-7a

The combined costs of North and Central Stockton to achieve the LS-7a alternative is provided in the integrated report.

3.3 Construction Schedule

The construction schedule was formulated on a variety of inputs and best estimates for production rates. The three big design constraints that needed to be evaluated holistically were: annual appropriations, construction production rates, and air emission concerns. Other issues which drive the schedule include PED, and real estate acquisition. While no specific design constraint would drive the schedule, they all serve as inputs to the construction schedule. For the purposes of this study, an annual appropriation of 100 million (federal) was targeted along with real estate constraints of 1 year for properties with clear title and 2 years for real estate acquisitions that would require condemnation.

3.4 Conclusion

Alternative LS-7a is the recommended plan for the Lower San Joaquin Feasibility Study based on the FDA analysis for maximizing net benefits. Alternative LS-7a includes levee fixes for 22 1/2 miles including geometric improvements to existing levees, cutoff walls, seismic fixes, erosion protection, and control structures. The recommended plan includes the construction of approximately 1 mile of new levee along Duck Creek and would include height increases along several reaches.

The cost of the recommended plan is provided in Chapter 3 of the draft report. Approximately 75% of the cost is projected for upgrades to the North Stockton area. Construction can reasonably be expected to last 14 years.

For more information on specific analysis presented refer to the various engineering addendums including: geotechnical engineering, cost engineering, hydrology and hydraulics.

APPENDIX

DISTRICT QUALITY CONTROL

SPK undertook the DQC per EC 1165-2-216, an internal review of basic engineering work focused primarily on fulfilling the project quality requirements for this study. The engineering disciplines which undertook DQC for their particular appendix were civil engineering (for this engineering summary), hydrology, hydraulic engineering, geotechnical engineering, and cost engineering.

DQC efforts for the various appendices were completed on the following dates:

Civil Engineering - Engineering Summary: 4/28/2016; 12/13/2017
Hydrology: 4/21/2016
Hydraulic Engineering: 4/22/2016
Geotechnical Engineering: 2/5/2016
Cost Engineering: 2/8/2016

A QC review and certificate was provided for each of the above Lower San Joaquin Feasibility Study appendices. The DQC methodology for SPK may have included a subsequent review if any additions or modifications were made to the original report. The dates provided above are the last known completed DQC reviews for the respective engineering disciplines.

TABLES

Table 1. Geographical Location and Description of Initial Alternatives for the LSJ Feasibility Study for the North Stockton and Central Stockton Area.

Geographical Location	Alternative	Description of Alternative
North Stockton	A	Delta Front from the intersection of Twin Brooks Lane and I-5 south along the existing levee located west of I-5, west on 5-Mile Slough, then south along the east side of the slough parallel to Hatchers Cir and Fort Donelson Dr encircling the north side of Lincoln Village West and continuing between W. Swain Rd and Canyon Creek Road to nearly Pershing Ave.
North Stockton	B	Delta Front from the intersection of Twin Brooks Lane and I-5 south along the existing levee located west of I-5, west on 5-Mile Slough, then south along the levee parallel to Hatchers Cir and Fort Donelson Dr continuing south along Brookside Road around Brookside Golf and Country Club continuing upstream of the right bank of the Calaveras River to El Dorado Street.
North Stockton	C	Delta Front from the intersection of Twin Brooks Lane and I-5 south along the existing levee located west of I-5, west on 5-Mile Slough, then south along the west side of the slough parallel to Hatchers Cir and Fort Donelson Dr encircling the south side of Lincoln Village West and continuing between W. Swain Rd and Canyon Creek Road to nearly Pershing Ave.
North Stockton	D	From I-5 and Lincoln Village West along the south side of the slough continuing south along Brookside Road around Brookside Golf and Country Club continuing upstream of the right bank of the Calaveras River to El Dorado Street.
North Stockton	E	From the Delta front up the right bank of the Calaveras River past the Stockton Diverting Canal to Cherryland Avenue.
North Stockton	F	Delta Front from the intersection of Twin Brooks Lane and I-5 south along the existing levee located west of I-5, west on 5-Mile Slough, then south along the levee parallel to Hatchers Cir and Fort Donelson Dr continuing south along Brookside Road around Brookside Golf and Country Club continuing upstream of the right bank of the Calaveras River to Cherryland Avenue.
Central Stockton	A	The left bank of the Calaveras River from approximately the intersection of Yacht Harbor Drive and Fairway Drive to the intersection with the Mormon Channel bypass.
Central Stockton	B	The east side of the Delta from just south of Country Club Blvd across the Smith Canal entrance (to Peninsula with closure gate structure). From the left bank of the Calaveras River from approximately the intersection of Yacht Harbor Drive and Fairway Drive to Pacific Avenue.
Central Stockton	C	From just south of the Port of Stockton shipping channel and the San Joaquin River to upstream of French Camp Slough to Walker Slough past I-5 to the first bend past I-5 on Walker Slough.

Central Stockton	D	The left bank of the Calaveras River from approximately the intersection of Yacht Harbor Drive and Fairway Drive to the intersection with the Mormon Channel bypass. The east side of the Delta from just south of Country Club Blvd across the Smith Canal entrance (to Peninsula). From just south of the Port of Stockton shipping channel and the San Joaquin River to upstream of French Camp Slough to Walker Slough past I-5 to the first bend past I-5 on Walker Slough.
Central Stockton	E	From the left bank of the Calaveras River from approximately the intersection of Yacht Harbor Drive and Fairway Drive to Pacific Avenue. Improvements around the existing levee around Smith Canal.

Geographical Location	Alternative	Description of Alternative
Central Stockton	F	The east side of the Delta from just south of Country Club Blvd across the Smith Canal entrance (to Peninsula with closure gate structure). From the left bank of the Calaveras River from approximately the intersection of Yacht Harbor Drive and Fairway Drive to Pacific Avenue. From just south of the Port of Stockton shipping channel and the San Joaquin River to upstream of French Camp Slough to Walker Slough past I-5 to the first bend past I-5 on Walker Slough.
Central Stockton	G	Diversion and improvement to Mormon Channel capacity of up to 1,200 cfs from Stockton Diverting Canal. The improvements along Mormon Channel would extend over 33,400 linear feet (6.3 miles), and include flood containment berms, bridge and culvert replacements, road relocations and channel clearing. This alternative provides for floodplain restoration in accordance with E.O. 11988 ecosystem/floodplain restoration goals.

Table 2. Geographical Location and Description of Initial Alternatives for the LSJ Feasibility Study for the San Joaquin River RD17 Area.

Geographical Location	Alternative	Description of Alternative
RD17	A	From I-5 at the south fork of Walker Slough around Westin Ranch via French Camp Slough south along the San Joaquin River to State Route 20.
RD17	B	South from State Route 20 along the tieback alignment to South Airport Way.
RD17	C	From I-5 at the south fork of Walker Slough around Westin Ranch via French Camp Slough south along the San Joaquin River along the tieback alignment to South Airport Way. (Alts A+C)
RD17	D	From I-5 at the south fork of Walker Slough around Westin Ranch via French Camp Slough south to Galley Way and French Camp Road. At Galley Way/French Camp Road traverse east, then south along S. Wolfe Way, east along W. Bowman Rd one-fourth the distance to I-5. From this location on Bowman Rd continue directly south to Dos Reis Rd and continue back to SJ River and continue along the tieback alignment to South Airport Way.
RD17	E	From I-5 at the south fork of Walker Slough around Westin Ranch via French Camp Slough south along the San Joaquin River along the tieback alignment to
RD17	F	Weston Ranch Ring Levee – includes new levee around Weston Ranch development plus an extension of RD 404 levees to prevent flanking during lower frequency events. The levees would total 6.3 miles.
RD17	G	San Joaquin River setback and tie-back extension – includes setback levees to limit protection of undeveloped floodplain within RD17. This alternative extends the tieback levee at the southern-most end of the reclamation district to minimize the probability of flanking during high water events. The setback/tie-back covers a total of 21.5 miles of levee.

Table 3. Geographical Location and Description of Initial Alternatives for the LSJ Feasibility Study for the Mormon Channel Bypass and Paradise Cut.

Alternative	Description of Alternative
Mormon Channel	Diversion and improvement to Mormon Channel capacity of up to 1,200 cfs from Stockton Diverting Canal. The improvements along Mormon Channel would extend over 33,400 linear feet (6.3 miles), and include flood containment berms, bridge and culvert replacements, road relocations and channel clearing. This alternative provides for floodplain restoration in accordance with E.O. 11988 ecosystem/floodplain restoration goals.
Paradise Cut	From the San Joaquin River to the intersection of W. Grimes Rd and S. Tracy Blvd.

Table 4. Dominant Failure Mode by Index Point

USACE Index	Failure Mode(s)
BL1	Under-seepage; erosion
BL2	Under-seepage; erosion
BL3	Under-seepage; erosion
BL4	Under-seepage; erosion
BR1	Under-seepage; erosion
BR2	Under-seepage; erosion
BR3	Under-seepage; erosion
BR4	Under-seepage; erosion
CL1	Through-seepage; landside stability; erosion
CL2	Through-seepage; landside stability; erosion
CR1	Through-seepage; landside stability; erosion
CR2	Through-seepage; landside stability; erosion
D1	Erosion; landside stability
D2	Erosion; landside stability
D3	Under-seepage; landside stability; erosion
D4	Landside stability; erosion
D5	Landside stability; erosion
D6	Through-seepage; erosion
FL1	Under-seepage; erosion
FR1	Under-seepage; erosion
LR1	Erosion; under-seepage
LR2	Seepage (through- and under-); landside stability; erosion
LR3	Seepage (through- and under-); landside stability; erosion
LR4	Seepage (through- and under-); landside stability; erosion
LR5	Seepage (through- and under-); landside stability; erosion
LR6	Seepage (through- and under-); erosion; landside stability
LR7	Seepage (through- and under-); landside stability; erosion
SL1	Landside stability; through-seepage
SL2	Landside stability; through-seepage
SR1	Landside stability; through-seepage

LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY
IN SUPPORT OF THE
INTERIM FEASIBILITY REPORT

REAL ESTATE PLAN
APPENDIX C

REVISED
8 December 2017

PREPARED
BY THE
SACRAMENTO DISTRICT
REAL ESTATE DIVISION
SOUTH PACIFIC DIVISION

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1. STATEMENT OF PURPOSE

This Real Estate Plan (REP) presents the real estate requirements and costs for the Interim Feasibility Report for the Lower San Joaquin River Study. The REP is prepared in accordance with ER 405-1-12, Section 12-16. The purpose and scope of the REP is to identify the real estate costs for the Feasibility Report's Recommended Plan (Alternative 7a), hereafter called "the Recommended Plan."

2. PROJECT AUTHORITY

The general authority for flood control investigations in the San Joaquin River Basin arises under the Flood Control Act of 1936 (Public Law [PL] 74-738), Sections 2 and 6, as amended by the Flood Control Act of 1938 (PL 75-761). The Flood Control Act of 1936, Section 6 explicitly permits further reports to be authorized by congressional resolutions. Further studies of this river system were directed in the 8 May 1964 resolution adopted by the Committee on Public Works of the House of Representatives. The resolution reads:

> "*Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Sacramento-San Joaquin Basin Streams, California, published in House Document No. 367, 81st Congress, 1st session, and other reports, with a view to determine whether any modifications to the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California.*"

The Lower San Joaquin River Feasibility Study (hereafter called the "LSJRFS") is being accomplished in accordance with the Section 905(b) Analysis (Water Resources Development Act (WRDA) 1986) dated 23 September 2004. The Section 905(b) Analysis was approved by the SPD Commander on 10 June 2005. The Section 905(b) Analysis was prepared with funds identified in House Report 108-357 (Conference Report to accompany H.R. 2745 for the Energy and Water Development Appropriations Act of 2004) for use under the Sacramento-San Joaquin River Basins Comprehensive Study for a reconnaissance study to evaluate environmental restoration, flood protection, and related purposes for the Lower San Joaquin River. House Report 105-190, which accompanied the Energy and Water Development Appropriations Act of 1998 (PL 105-62), authorized the Sacramento and San Joaquin River Basins Comprehensive Study (Comprehensive Study).

The Section 905(b) Analysis determined that there was Federal interest in pursuing feasibility level investigations for potential flood risk reduction and ecosystem restoration projects in the Lower San Joaquin River area. The LSJRFS has been focused on flood risk reduction through additional scoping and coordination with the non-Federal sponsors, resource agencies and local stakeholders.

The LSJRFS will only partially address the Sacramento – San Joaquin Basin Streams, California Comprehensive Study authority. Therefore, the LSJRFS will be called an "Interim Feasibility Report," which indicates that the study is addressing the flood risk issues of a specific area within the authority, rather than the entire area authorized for study.

3. PROJECT DESCRIPTION

Levees in the LSJRFS project area require improvements to address seepage, slope stability, overtopping, and erosion concerns. The Recommended Plan is composed of different structural measures, or building blocks, to address these problems. The Recommended Plan includes the following measures: (1) 22.4 miles of seepage cutoff walls; (2) 3.2 miles of geometric improvements consisting of levee slope and crown reshaping to meet Federal standards; (3) 3.5 miles of levee height raises mainly to reestablish the design levee height; (4) 0.5 miles of flood walls/sheet pile walls; (5) 0.75 miles of new levee, and (6) 5 miles of new erosion protection (a majority of the new protection would be on the landside only; any existing erosion protection disturbed by construction would be repaired or replaced). These features overlap one another and cannot be totaled to describe the total length of the project. The approximate length of horizontal flood features (including closure structures) is approximately 23.9 miles.

The project footprint for the Recommended Plan includes: the portion of the San Joaquin River between French Camp Slough and the railroad bridge 14 miles below the Stockton Deep Water Shipping Channel (hereafter the "Stockton DWSC"); French Camp Slough from El Dorado Street to the San Joaquin River; the Calaveras River from North El Dorado Street to the San Joaquin River; portions of the Stockton DWSC between Smith Canal and Fourteen Mile Slough; the west side of Fourteen Mile Slough, Tensile Slough, and Five Mile Slough to Mosher Slough; and the south side of Mosher Slough .41 miles beyond N. Eldorado Street up to the railroad tracks.

These levee improvement measures would be implemented primarily by fixing levees in place. In addition to levee improvements, the Recommended Plan includes two in-water closure structures at Fourteen Mile Slough and Smith Canal. Figure 1 identifies where each measure would be required. Once a levee is modified, regardless of the measure implemented, the levee would meet the Corps' levee design criteria. Table 1 is a summary of the structural measures of the Recommended Plan.

Figure 1 – Lower San Joaquin Feasibility Study

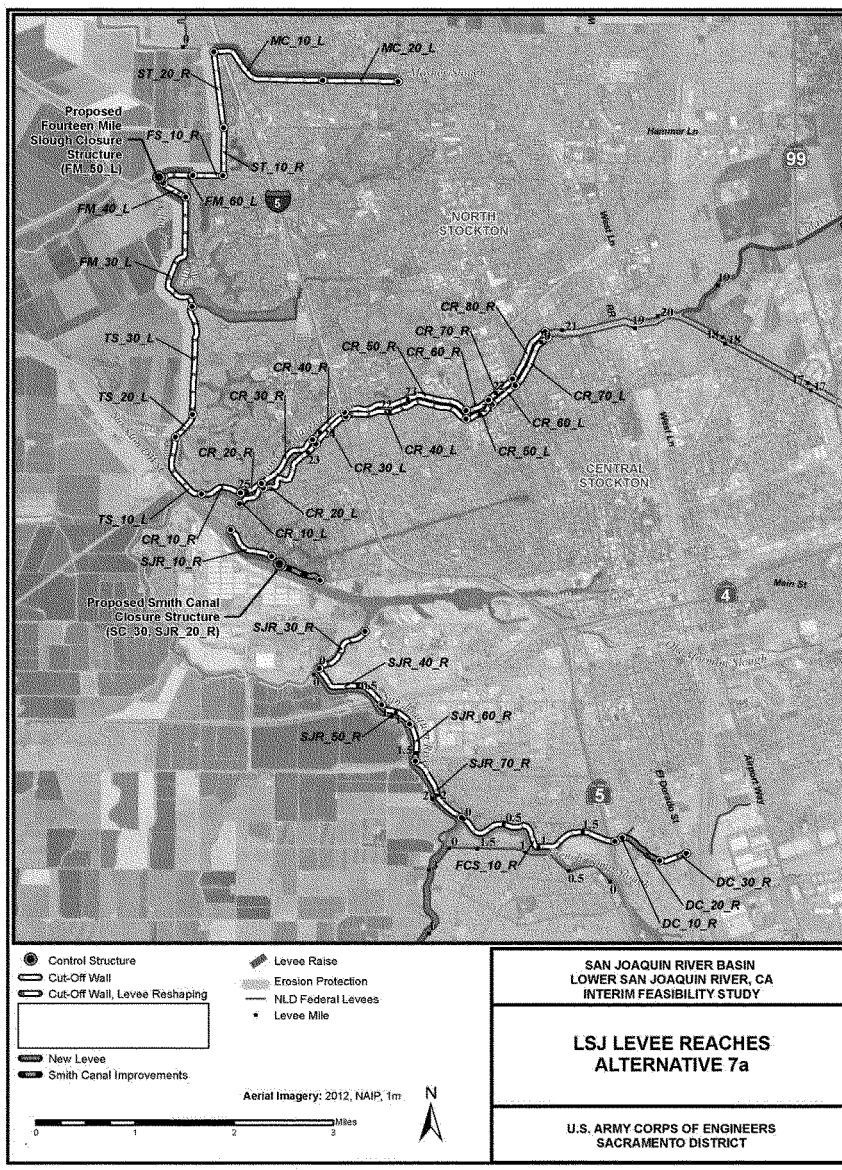


Table 1 – Structural Measures of the Recommended Plan

NORTH STOCKTON		
Reach	**Vicinity**	**Measure**
Mosher Slough	Thornton Road to UPRR Railroad Tracks	Cutoff Wall
Mosher Slough	Shima Tract to Thornton Road	Cutoff Wall; Levee Height Fix
Shima Tract and Five mile Slough	Mosher Slough to Five mile Slough	Cutoff Wall; Erosion Protection (Landside)
Shima Tract and Five mile Slough	Shima Tract to Fourteen mile Slough	Cutoff Wall; Erosion Protection (Landside)
Fourteen mile Slough	Five mile Slough to Proposed Closure Structure	Cutoff Wall; Levee Height Fix; Erosion Protection (Landside)
Fourteen mile Slough	Approximately 1,500 feet west of Five mile Slough	Closure Structure
Fourteen mile Slough	Approximately 1,250 feet southeast setback out from proposed closure structure	Cutoff Wall; Levee Height Fix; Erosion Protection (Landside)
Fourteen mile Slough	From setback cut south to Tensile Slough	Cutoff Wall; Slope Reshaping; Erosion Protection (Landward)
Tensile Slough	Fourteen mile Slough to March Lane	Cutoff Wall; Slope Reshaping; Erosion Protection (Waterside)
Tensile Slough	March Lane to West March Lane/Buckley Cove Way	Seismic Fix; Slope Reshaping; Erosion Protection (Waterside)
Tensile Slough/Buckley Cove Marina/San Joaquin River	West March Lane/Buckley Cove Way to Calaveras River	Seismic Fix; Slope Reshaping
Calaveras River – Right/North Bank	San Joaquin River to North El Dorado Street	Cutoff Wall
CENTRAL STOCKTON		
Reach	**Vicinity**	**Measure**
Calaveras River – Left/South Bank	San Joaquin River to approximately I-5	Cutoff Wall
Calaveras River – Left/South Bank	Approximately I-5 to approximately North Pershing Avenue	Cutoff Wall; Slope Reshaping
Calaveras River – Left/South Bank	Approximately North Pershing Avenue to approximately El Dorado Street	Cutoff Wall
San Joaquin River	From approximately 2,100 feet upstream of the Calaveras River to the proposed Smith Canal Closure Structure	Cutoff Wall; Levee Height Fix (Sea Level Rise)
Smith Canal	At the mouth of the canal between Brown's Island and Dad's Point	Closure Structure
Smith Canal	Dad's Point from the Closure Structure to approximately 375 feet down Monte Diablo Avenue	Floodwall

Reach	Vicinity	Measure
San Joaquin River	Railroad bridge just upstream of the Port of Stockton to Burns Cutoff	Cutoff Wall; Slope Reshaping
San Joaquin River	Burns Cutoff to French Camp Slough	Cutoff Wall
French Camp Slough – Right/North Bank	French Camp Slough confluence with the San Joaquin River to approximately 500 feet southwest of I-51	Cutoff Wall
Duck Creek	500 feet past I-5 cross to approximately Odell Avenue	New Levee
Duck Creek	Approximately Odell Avenue to McKinley Avenue	Cutoff Wall; Levee Reshaping; Levee Height Fix

4. DESCRIPTION OF LANDS, EASEMENTS, RIGHTS-OF-WAY, RELOCATIONS AND DISPOSALS

The Lands, Easements, Rights-of-Way, Relocations and Disposal (LERRD) requirements of the Recommended Plan are estimated to cost $189,101,000. The Recommended Plan will impact an estimated 368.51 acres across 460 parcels (See Table 2, below).

Mitigation Rights –

In the Delta Front Reach of the Recommended Plan 14.00 acres have been identified for acquisition in fee simple to provide necessary on-site planting mitigation. No other mitigation acreage has yet been identified on cadastral maps.

For planning purposes the project's potential adverse effect on jurisdictional wetlands and other habitats requiring mitigation would be compensated by the purchase of mitigation credits from authorized mitigation banks at an estimated cost of *$48,569,000. The cost of credits purchased from mitigation banks is not defined as a real estate cost and therefore is not included in the REP.

*[This number was provided by Planning and Cost Engineering. Real Estate Division makes no representation that $48,569,000 is an accurate estimate of probable project mitigation costs.]

Permanent Flood Protection Levee Easements –Approximately 194.07 acres of levee easements are needed for construction of new levees, levee raises, levee seismic remediation, construction of cutoff walls and levee reshaping. These easements must reserve the right to construct, maintain, repair, operate and patrol the respective flood protection features. The estimated area needed for project easements includes all lands from landside toe to waterside toe of existing and proposed project levees.

Permanent Roadway Easements - Approximately 35.94 acres of permanent roadway easements are needed for access roads at the landside toe and waterside toe of existing and proposed levees. These easements are needed for O&M activities and inspections.

Permanent Channel Improvement Easements – Approximately 2.12 acres of channel improvement easements are needed to maintain a canal at the proposed Fourteen Mile Slough Closure Structure within the Delta Front reach.

Temporary Work Area Easements for Borrow Areas – Up to 1.4 million cubic yards of borrow material and 138 acres of borrow lands could be needed to construct the project. Borrow material estimates are explained in Appendix B – Engineering Summary, Section 2.9.6. Potential locations for borrow material were identified by the San Joaquin Area Flood Control Agency, a project sponsor. The potential borrow material sites have not been field tested. The borrow areas are not yet identified on cadastral maps. Typically projects constructed by the Sacramento District utilize commercial borrow sites near the project area. Tentative borrow sites have been identified, however once the project is authorized, borrow requirements, identification and evaluation of potential borrow locations will be reevaluated during PED. Whether sufficient borrow material may be found within a reasonable distance, at reasonable cost, and without unacceptably adverse environmental effects, has not yet been analyzed.

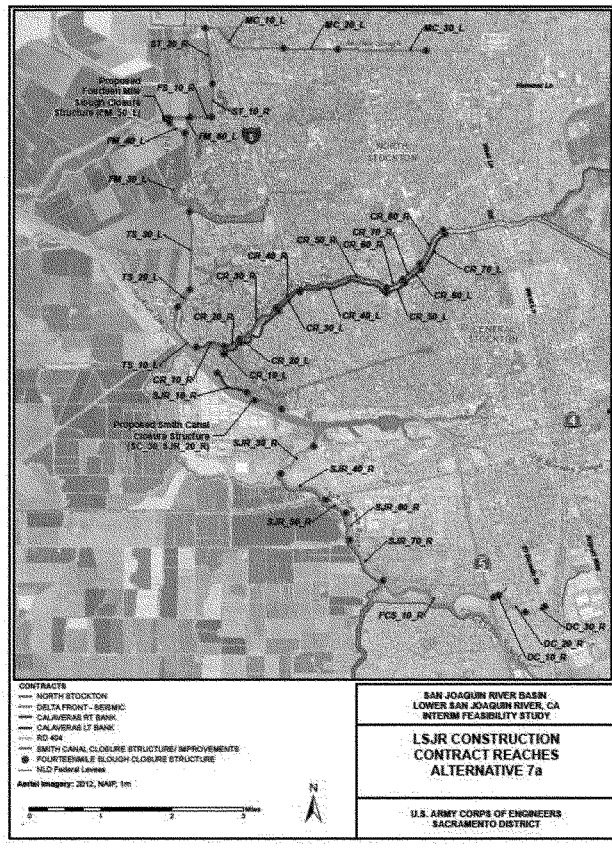
Staging and Access Easements – For planning purposes staging areas for project construction are presumed to be located within levee rights-of-way. The project sponsors hold sufficient interest in existing rights-of-way to support temporary access and staging requirements. Staging areas for construction of the closure structures on Fourteen Mile Slough and the Smith Canal would be immediately adjacent to the levees on either side of the closure structures. The staging and access areas are not yet identified on cadastral maps. Project improvement and construction work will impact approximately 23.9 linear miles of levees. The rule of thumb that a project contractor requires one acre of staging ground for each mile of levee improvement work equates to an estimated need for temporary rights-of-way for access and staging over approximately 23.9 acres at sites adjacent to the project footprint. An estimate of the cost for obtaining 23.9 acres of Standard Temporary Work Area Easements is included in the Recommended Plan Cost Summary. If the project is authorized, temporary work area location identifications will be completed during PED.

Table 2 is a summary of the parcels, estates and acreage required for the Recommended Plan with an associated location map at Figure 2 – Lower San Joaquin Feasibility Study

Table 2 - Recommended Plan Lands, Easements and Rights-of-Way

North Stockton Reach	**Parcels**	**Estate**	**Acres**
	227	Flood Protection Levee Easement	34.69
		Roadway Easement	8.99
Delta Front Reach	**Parcels**	**Estate**	**Acres**
	56	Flood Protection Levee Easement	45.17
		Roadway Easement	22.97
		Channel Improvement Easement	2.12
		Fee	14.00
Fourteen Mile Slough Closure Structure Reach	**Parcels**	**Estate**	**Acres**
	1	Flood Protection Levee Easement	0.29
Calaveras Right Bank Reach	**Parcels**	**Estate**	**Acres**
	108	Flood Protection Levee Easement	29.19
Calaveras Left Bank Reach	**Parcels**	**Estate**	Acres
	109	Flood Protection Levee Easement	40.96
		Roadway Easement	1.53
Smith Canal Closure Structure Reach	**Parcels**	**Estate**	**Acres**
	2	Flood Protection Levee Easement	1.51
RD 404 Reach	**Parcels**	**Estate**	**Acres**
	27	Flood Protection Levee Easement	41.72
		Roadway Easement	2.45
All Reaches Temporary Staging Areas			
			23.9

Figure 2 – Lower San Joaquin Feasibility Study Recommended Plan Reaches.



5. LERRDs OWNED BY THE NON-FEDERAL SPONSOR (NFS) AND CREDITING

The Sacramento and San Joaquin Drainage District, acting by and through the Central Valley Flood Protection Board of the State of California, and the San Joaquin Area Flood Control Agency, the non-Federal sponsors, hold 128.33 acres of access and flood protection levee easements in the Recommended Plan footprint. These easements will be made available for the project.

On March 20, 2015 the non-Federal Sponsors were notified in writing of the risks of acquiring right-of-way interests prior to execution of a Project Partnership Agreement

and prior to issuance of a notice to proceed with real estate acquisition. A copy of the letter is attached at Exhibit A.

6. ESTATES

The non-Federal sponsors will acquire the minimum interests in real estate necessary to support the construction and subsequent operation and maintenance of the Recommended Plan. The following standard estates are identified and defined for the project:

Fee Simple Title
Fee simple title to project lands, subject to existing easements for public roads and highways, public utilities, railroads and pipelines.

Channel Improvement Easement
A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across the lands described therein, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate; dredge, cut away, and remove any and all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Flood Protection Levee Easement
A perpetual and assignable right and easement in the lands described therein to construct, maintain, repair, operate, patrol and replace a flood protection levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Permanent Road Easement
A perpetual and assignable easement and right-of-way in, on, over and across the lands described therein for the location, construction, operation, maintenance, alternation and replacement of (a) road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in the lands described therein, subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Temporary Work Area Easement
A temporary easement and right-of-way in, on, over and across the lands described therein, for a period not to exceed 2 years after the execution of the construction contract, beginning with the date possession of the land is granted to the United States or the Non-Federal Sponsor, for use by the United States and the Non-Federal Sponsor, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Lower San Joaquin River Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Construction and Maintenance Cooperative Agreement (Non-Standard Estate)
A portion of the proposed project will occur on property under the jurisdiction of the U.S. Department of Transportation Federal Highway Administration and controlled by the State of California Department of Transportation (Caltrans) in the North Stockton Levees Reach, consisting of approximately 0.36 acres for flood protection levees and maintenance roads. According to California law, whenever there is an exchange of effort between Caltrans and a public entity regarding construction of an improvement on the State Highway System, a cooperative agreement is required. The cooperative agreement to be acquired by the non-federal sponsor will require approval from headquarters (HQUSACE) during the Planning, Engineering and Design Phase of the project.

7. DESCRIPTION OF ANY EXISTING FEDERAL PROJECTS IN OR PARTIALLY IN THE PROPOSED PROJECT'S FOOTPRINT

The Recommended Plan partially lies within the lands, easements and rights-of-way of the existing Lower San Joaquin River and Tributaries Project. The existing flood control project was authorized by the Flood Control Act of 1944 and construction was initiated in 1956. The degree of overlap between existing Federal project levees and the footprint of the Recommended Plan has not yet been calculated.

The sponsors will not receive credit for lands, easements or rights-of-way that were previously provided as an item of cooperation for the Lower San Joaquin River and Tributaries Project. Approximately 128.33 acres of previously credited permanent rights-of-way partially lie within the Recommended Plan, leaving an additional 240.18 acres for which real property rights must be acquired.

8. DESCRIPTION OF ANY FEDERALLY-OWNED LAND NEEDED FOR THE PROJECT

Approximately 0.36 acres of one parcel of land owned by the U.S. Department of Transportation in the North Stockton Levees Reach would be needed for construction of a project cutoff wall, based on the conceptual design.

9. APPLICATION OF THE NAVIGATION SERVITUDE TO THE LERRDs REQUIREMENT

The navigation servitude is the dominant right of the Government under the Commerce Clause of the U.S. Constitution to use, control and regulate the navigable waters of the United States and submerged lands thereunder.

The revetment measure will be constructed from the landside of the levee. The project does not require lands, easements or rights-of-way within any navigable watercourses. Therefore, the federal navigation servitude will not be invoked for this project.

10. PROJECT MAP

The Recommended Plan Cadastral Map and Track Register are attached at Exhibit C.

11. NO INCREASED FLOODING ANTICIPATED

Induced flooding is defined as any ancillary increase in the depth, duration or frequency of area flooding caused by a project's modifications to existing structures or construction of new structures. Hydrological studies were undertaken to estimate the potential of the modified and new structures of the Recommended Plan to induce additional flooding. Results showed that in no project reaches would implementation of the Recommended Plan induce additional flooding over the "no action alternative."

12. COST ESTIMATE

The following baseline cost estimate, set forth in Table 4, below, reflects the total costs to acquire the LERRDs needed to build the Recommended Plan. The date of the approved cost estimate was January 2016. The estimate includes costs for LERRD acquisitions as well as for administrative costs and potential condemnation and relocation costs. Displaced persons and businesses may be entitled to relocation assistance benefits (as required by Public Law 91-646, Title II as amended, the "Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970").

Table 4 – Recommended Plan Cost Summary

Lower San Joaquin Feasibility Study Recommended Plan Cost Summary		LERRDs Include a 35% Contingency Factor
01 ACCOUNT – LERRDs (NON-FEDERAL)		
Non-Federal Real Estate Administrative Costs (460 parcels)		$25,620,000
P.L. 91-646 Payment Assistance Relocations		$29,154,000
Subtotal:		$54,774,000
Non-Federal Lands/Damages		
North Stockton Reach		$627,351
Delta Front Reach		$3,563,170
Fourteen Mile Slough Closure Structure Reach		$6,821
Calaveras Right Bank Reach		$1,174,252
Calaveras Left Bank Reach		$3,792,906
Smith Canal Closure Structure Reach		$244,475
RD 404 Reach		$1,183,322
All Reaches Temporary Staging Areas		$4,612,300
Subtotal (Non-Fed Lands and Damages):		$15,204,597
Non-Fed Lands and Damages/Admin/91-646:		$69,978,597
Federal Real Estate Administrative Costs:		$10,675,000
Non-Federal/Federal 01 Account Costs:		$80,653,597
	ROUNDED	$80,654,000
02 ACCOUNT – RELOCATIONS		
*Utility/Facility Relocation Costs:		$78,585,000
Contingency 38%		$29,862,000
Total 02 Account Costs:		$108,447,000
TOTAL LERRDs COSTS (01 AND 02 ACCOUNTS)	**(ROUNDED)**	**$189,101,000**

*Note – The Total Project Cost Summary displayed in the Cost Engineering Appendix will include Accounts 30 and 31 for all relocations and construction items combined.

13. RELOCATION ASSISTANCE BENEFITS

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (PL 91-646) may require payment of relocation assistance benefits to businesses or residents which are forced by the Project to vacate their property either temporarily or permanently. Payments to residents may include reimbursement of costs for storage of

household goods, moving costs, lodging, incidentals, differential payments, etc. Businesses could be entitled to receive advisory services, reimbursement for actual reasonable moving costs, re-establishment costs and certain reasonable and necessary incidental costs associated with their relocation.

A preliminary estimate of potential PL 91-646 displacements was prepared by the Sacramento District Real Estate and Engineering Divisions. The impacts and estimates relating to potential displacements, and the anticipated need to provide relocation assistance benefits, are provided for project cost estimating purposes only and are not intended to be relied upon for provision of benefits and/or payment of the estimates referenced herein. Should the project be authorized, a relocation plan will be provided by the non-Federal Sponsor. Table 5 is the Recommended Plan Uniform Relocation Assistance Summary.

Table 5 – Recommended Plan Uniform Relocation Assistance Summary (PL 91-646)

Reach	**Number of Structures**	**Relocation Assistance Payments**
North Stockton Reach	113	$29,154,000
Total:		**$29,154,000**

14. MINERAL/TIMBER ACTIVITY/WATER RIGHTS

No timber harvesting or mineral extraction operations are currently active along the San Joaquin River and tributaries levees in the project area. No water rights are expected to be needed in support of the Recommended Plan and project construction and operation should have no impact on known water rights within the project footprint.

15. NON-FEDERAL SPONSOR'S ABILITY TO ACQUIRE

The San Joaquin Area Flood Control Agency and the Sacramento and San Joaquin Drainage District, acting by and through the Central Valley Flood Protection Board of the State of California, will be required to serve as the Non-Federal Sponsors (NFS) for project construction and operation, maintenance, repair, rehabilitation and replacement responsibilities if this project is authorized. Each sponsor has legal authority to acquire and hold title to real property for the project under State of California Water Code Section 8590. The sponsors also have the power of eminent domain and "quick-take" authority that may be used for this project.

16. ZONING ANTICIPATED IN LIEU OF ACQUISITION

No application or enactment of zoning ordinances in lieu of, or to facilitate, acquisitions for this project is presently anticipated.

17. ACQUISITION SCHEDULE

For the purposes of this study, an annual appropriation of 100 million dollars (federal) was targeted along with the Non-Federal Sponsor's schedule for acquiring rights-of-way. The Recommended Plan would be constructed in seven reaches over a 15 1/2-year period, with project scheduling dependent upon federal appropriations. Table 6 sets forth the Recommended Plan Real Estate Acquisition Schedule.

Table 6 –Recommended Plan Real Estate Acquisition Schedule

REAL ESTATE ACQUISITION SCHEDULE				
Project Name: Lower San Joaquin River Flood Reduction Project	COE Start	COE Finish	NFS Start	NFS Finish
Receipt of Preliminary Drawings from Engineering	2017	2021		
Receipt of Final Drawings from Engineering	2019	2023		
Formal Transmittal of Final Drawings and Instruction to Acquire LEERDS	2019	2023	2019	2023
Construction Contracts: Calaveras Left Bank Levees Smith Canal Closure Structure RD 404 Levees Calaveras Right Bank Levees Delta Front Levees Fourteen Mile Closure Structure North Stockton Levees	 2020 2020 2019 2021 2022 2022 2023	 2020 2020 2019 2021 2022 2022 2023		
Conduct Landowner Meetings			2019	2029
Prepare/Review Mapping & Legal Descriptions			2019	2029
Obtain/Review Title Evidence			2019	2029
Obtain/Review Tract Appraisals			2019	2029
Conduct Negotiations			2019	2029
Condemnation			2019	2029
Prepare/Review Condemnations			2019	2029
Perform Condemnations			2019	2029
Obtain Possession			2019	2029
Complete/Review PL 91-646 Benefit Assistance			2019	2029
Certify All Necessary LERRDS for Construction			2019	2029

Prepare and Submit Credit Requests			2019	2029
Review/Approve or Deny Credit Requests	2020	2029		
Establish Value for Creditable LERRDS	2020	2029		

18. DESCRIPTION OF FACILITY AND UTILITY RELOCATIONS

On January 10, 2013, the Corps issued Real Estate Policy Guidance Letter No. 31--Real Estate Support to Civil Works Planning Paradigm (3x3x3) ("PGL No. 31") establishing additional Corps policy guidance for feasibility-level real estate efforts directed at identifying, defining and estimating the costs of utility/facility relocations for planning and budgeting purposes. In qualifying instances, a real estate assessment, in lieu of an attorney's preliminary opinion of compensability, may be prepared and utilized for such purposes (although a final attorney's opinion of compensability will be required for specified relocations prior to execution of the Project Partnership Agreement between the Corps and the non-Federal sponsors.).

The Utility/Facility Inventory table and cost estimates discussed herein and available in Exhibit D set forth the following information: identification of the utilities/facilities within the project area anticipated to be impacted by the construction, operation and maintenance of the project and thus require "relocation" (as defined in applicable law and regulations); the District's preliminary efforts to identify owners with compensable interests in the impacted utilities/facilities and their eligibility for the provision of a substitute or replacement facility under applicable law and regulations; and identification of the non-Federal sponsors' performance and cost responsibilities in connection with the identified relocations for this cost-shared project.

Consistent with requirements of PGL No. 31, the preparation of a real estate assessment is appropriate for this feasibility study because the estimated total cost to modify all project utility/facility relocations identified in the Utility/Facility Inventory (including the value of any additional lands that may be required to perform the relocations) for the Recommended Plan do not exceed 30 percent of estimated total project costs. Here, total project costs are estimated at $1.1 billion dollars and the utility relocations are estimated at $108,447,000, which is below the 30% threshold.

The real estate assessment discussed herein, and presented in Exhibit D, is based upon the following assumptions to assist in analyzing and determining compensability for study planning and budgeting purposes:

(1) If an impacted utility/facility is likely operated under a permit that has been issued to the utility/facility owner by the underlying property owner, and the terms of the permit include conditional language stating the utility/facility owner must relocate the

impacted utility/facility at its own expense at request of the underlying fee or easement owner, the relocation is categorized as a non-compensable relocation, the costs of which are borne by the utility/facility owner and/or the non-Federal sponsor, and are not included in the total project cost estimate.

(2) If the owner of the impacted utility/facility likely has an easement or real property interest in the underlying land, and the utility/facility so impacted appears to meet the criteria for the provision of a substitute and/or replacement facility under the substitute facilities doctrine, the relocation is categorized as a compensable relocation, the costs of which are borne by the non-Federal sponsor and included in the total project cost estimate.

Final Attorney's Opinions of Compensability will be completed during the PED Phase and prior to the execution of the Project Partnership Agreement, as well as prior to issuance of any notice to proceed to obtain lands and perform relocations by the non-Federal sponsors.

Various utilities/facilities are located within the project boundaries and must be relocated to allow for project construction. These utilities/facilities consist of electrical distribution and service facilities, telephone communication lines, irrigation facilities, roadways, water delivery facilities and natural gas pipelines. A summary of their assessment of compensability, referencing the data set forth in the Relocation Inventory Table, is as follows:

The following utilities/facilities appear to be non-compensable relocations:

North Stockton Reach Items – 50, 54-56; Delta Front Reach Items – 40-42; Calaveras Right Bank Reach Items – 2, 5, 7, 9-10, 14, 16-17, 23, 26, 34; Calaveras Left Bank Reach Items – 1-9, 11-12, 18-20, 24, 26, 29-41, 43, 46; RD 404 Reach Items – 52, 56, 58-61, 71, 73-75, 77, 80, 84-85, 89-90, 92, 95, 98

The following utilities/facilities appear to qualify as compensable relocations:

North Stockton Reach Items – 46-49, 51-53, 57 (gas main), 58; Delta Front Reach Items – 35-36, 37 (petroleum pipeline), 38-39, 43-45; Calaveras Right Bank Reach Items – 3, 6 (gas lines), 15 (power poles), 19-21, 24, 27-28, 30-33; Calaveras Left Bank Reach Items – 10, 16-17, 21-23, 25, 27-28, 47; RD 404 Reach Items – 48-51, 53-55, 57, 62-70, 72, 76, 78-79, 81-83, 88, 91, 93, 94

The following utilities/facilities may or may not be compensable. Information is not available to make a preliminary assessment as to whether the utilities/facilities are compensable relocations. The submission of additional data and further analysis is required:

Calaveras Right Bank Reach Items – 18 (sewer line through levee no data); Calaveras Left Bank Reach Items – 45 (domestic gas line through levee to residence on waterward side); RD 404 Reach Items – 87 (telephone conduit through levee), 96-97 (power poles)

Table 7 – Code of Accounts 02 Utility/Facility for the Recommended Plan

Reach	Cost
North Stockton Reach	$4,961,000
Delta Front Reach	$7,984,000
Calaveras Right Bank Reach	$17,980,000
Calaveras Left Bank Reach	$2,837,000
RD 404 Reach	$27,831,000
30 & 31 PED	$16,992,000
Subtotal:	$78,585,000
Contingency (38%)	$29,862,000
*Total:	$108,447,000

*Note: Construction Management Costs and PED costs for all construction items are displayed in the MII Cost Engineering Appendix. The Utility Facility Inventory table and costs discussed herein are available in Exhibit D.

ANY CONCLUSION OR CATEGORIZATION CONTAINED IN THIS REAL ESTATE PLAN (AND THE FEASIBILITY REPORT) THAT AN ITEM IS A UTILITY OR FACILITY RELOCATION TO BE PERFORMED BY THE NON-FEDERAL SPONSOR AS PART OF ITS LERRD RESPONSIBILITIES AND/OR IS OTHERWISE COMPENSABLE OR NON-COMPENSABLE IS PRELIMINARY AND FOR DISCUSSION PURPOSES ONLY. THE GOVERNMENT WILL MAKE A FINAL DETERMINATION OF THE RELOCATIONS NECESSARY FOR THE CONSTRUCTION, OPERATION, OR MAINTENANCE OF THE PROJECT AFTER FURTHER ANALYSIS AND COMPLETION AND APPROVAL OF THE FINAL ATTORNEY'S OPINIONS OF COMPENSABILITY FOR EACH OF THE IMPACTED UTILITIES AND FACILITIES DURING FINAL DESIGNS.

19. HAZARDOUS, TOXIC AND RADIOLOGICAL WASTE IMPACTS

A Phase I Environmental Site Assessment conducted within the study area identified seven hazardous waste sites variously located between 250 feet and 900 feet from the centerline of the nearest project levee section. The likelihood that soil contamination may be encountered during excavation for project construction was judged "low" in the vicinity of 5 of the 7 sites, "medium" at one of the sites, and "possible" at one site. See Table 8, below.

Costs for removal and disposal of any contaminated soil must be paid by the project's non-Federal sponsors. But the Phase I Environmental Site Assessment found

no evidence of HTRW conditions that could delay the project's schedule for acquisition of real property rights. A map of identified HTRW sites is provided at Appendix A – Environmental, Section A-12, Chapter A-12-1, Section 4, Figure 3a. HTRW contaminated soil removal is explained in Appendix B – Engineering Summary, Section 2.12.

Table 8 - Hazardous Waste Sites Summary

Site	**Possible Contaminant**	**Distance to Levee (ft)**	**Potential for Levee Clean-up**
Brea Ag Service 1905 N. Broadway	Pesticide, fertilizer, groundwater contamination	~ 250-ft	Possible
Colon Property 5681 E. Marsh Rd.	Junkyard, possible lead in soil	~ 350-ft	Medium
Beacon Property #27 3300 Waterloo Rd.	Gasoline contamination	~ 650-ft	Low
Fisco Warehouse 1648 Shaw Rd.	Diesel contamination	~ 900-ft	Low
Don's Buggy Shop 3245 Wilson Way, N	Gasoline contamination	~ 800-ft	Low
Certified Grocers of California 1990 Piccoli St., N	Diesel contamination	~ 900-ft	Low
PG&E (Case #2) 4040 West Ln., N	Gasoline contamination	~ 900-ft	Low

20. ATTITUDE OF LANDOWNERS

The project has received wide-spread support from the community; however, the attitudes of the landowners who will be directly affected by its construction are not known. The Non-Federal Sponsors are confident that they will be able to acquire the rights-of-way required for the project.

21. CULTURAL RESOURCE ISSUES

The Recommended Plan has the potential to adversely affect cultural resources during placement of cutoff walls, seepage berms, deep soil mixing, levee raises and closure structures. The records and literature search, reconnaissance survey, and the regional history of the area have identified at least 30 previously recorded cultural resources and the likelihood of additional unknown historic properties within the study

area. In particular the prehistoric overview and previously recorded prehistoric sites suggests a high probability that multiple prehistoric villages on the San Joaquin River and tributaries would be affected. The likelihood is also high for discovery of additional historic-era structures and features within the project. It is likely that historic properties will be adversely affected by the Recommended Plan. Effects to cultural resources under the Recommended Plan would be significant and unavoidable.

22. ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY

Project: LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY

Sponsors: San Joaquin Area Flood Control Agency
Sacramento and San Joaquin Drainage District acting by and through the Central Valley Flood Protection Board of the State of California

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? YES

Please cite the authority: STATE OF CALIFORNIA WATER CODE SECTION 8590

b. Does the sponsor have the power of eminent domain for this project? YES

c. Does the sponsor have "quick-take" authorities for this project? YES

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? NO

e. Are any of the lands or interests in land required for the project owned by an entity whose property the sponsor cannot condemn? NO

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? NO

b. If the answer to II.a. is "yes," has a reasonable plan been developed to provide such training? N/A

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? YES

d. Is the sponsor's project in-house staffing level sufficient considering its other workload, if any, and the project schedule? YES

e. Can the sponsor obtain contractor support, if required, in a timely fashion? YES

f. Will the sponsor likely request U.S. Army Corps of Engineers (USACE) assistance in acquiring real estate? NO

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? YES

b. Has the sponsor approved the project real estate schedule/milestones? YES

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USAGE projects? YES

b. With regard to this project, the sponsor is anticipated to be: The State of California, Central Valley Flood Protection Board

V. Coordination:

a. Has this assessment been coordinated with the sponsor? YES

b. Does the sponsor concur with this assessment? YES

Prepared by:

Elizabeth A. Youn
Realty Specialist
Acquisition and Management Branch

Reviewed and Approved by:

Diane M. Simpson
Chief, Real Estate Division

LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY
REAL ESTATE PLAN

EXHIBIT A

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO CALIFORNIA 95814-2922

March 20, 2015

Acquisition and Management Branch

Central Valley Flood Protection Board
Executive Officer
3310 El Camino Avenue, Room LL40
Sacramento, CA 95821

San Joaquin Area Flood Control Agency
Executive Director
22 East Weber Avenue, Room 301
Stockton, CA 95202-2317

To Whom It May Concern:

Our purpose for writing is to caution the Central Valley Flood Protection Board and San Joaquin Area Flood Control Agency, the non-Federal partners to the Lower San Joaquin River Feasibility Project, that there are many risks associated with the acquisition of lands prior to project authorization, execution of a Project Partnership Agreement and Federal Government giving formal notice to proceed with land acquisitions.

The U.S. Army Corps of Engineers must caution and advise that there are many risks associated with right-of-way acquisition under such circumstances and that, as the non-Federal partners, your agencies assume full and sole responsibility for any and all costs, or liability arising out of the acquisition effort. Generally, these risks include, but may not be limited to the following:

a. The Congress of the United States may not appropriate funds to construct the proposed project.

b. A Project Partnership Agreement (PPA) mutually agreeable to the Central Valley Flood Protection Board (CVFPB) and San Joaquin Area Flood Control Agency (SJAFCA) and the Federal Government may not be executed and implemented.

c. The CVFPB and SJAFCA may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42, U.S.C. 9601-9675.

d. The CVFPB and SJAFCA may acquire interests or estates in real property that are later determined by the Federal Government to be inappropriate, insufficient, or otherwise not required for the project.

e. The CVFPB and SJAFCA may initially acquire insufficient or excessive real property acreage which may result in additional negotiations, payment of Public Law 91-646 (as amended) benefits, or payments of fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the said formal notice by the Corps to commence acquisition of land and right of way.

f. The CVFPB and SJAFCA may incur costs or expenses in connection with its decision to acquire or perform acquisition activities in advance of the Project Authorization, an executed PPA, and the Government's notice to proceed which may not be creditable under the provisions of Public Law 99-662, The Water Resources Development Act of 1986.

Should you have any questions regarding project real estate matters, please contact Ms. Elizabeth Youn of our staff at (916) 557-7013. For questions concerning project execution and partnership agreements, please contact Ms. Joana Savinon, Project Manager, at (916) 557-7098.

Sincerely,

ORIGINAL SIGNED

Stan J. Wallin
Chief, Real Estate Division

LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY
REAL ESTATE PLAN

EXHIBIT B

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET NW
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CEMP-CR

JAN 10 2013

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Real Estate Policy Guidance Letter No. 31-Real Estate Support to Civil Works Planning Paradigm (3x3x3)

1. References.

a. Memorandum, CECW-CP, 8 February 2012, Subject: U.S. Army Corps of Engineers Civil Works Feasibility Study Program Execution and Delivery

b. ER 5-1-11, USACE Business Process, 1 November 2006

c. EC 405-1-04, Appraisal, 30 Dec 2003

d. ER 1105-2-100, Planning Guidance Notebook, 22 Apr 2000

e. ER 405-1-12, Chapter 12, Real Estate Roles and Responsibilities for Civil Works, Cost Shared and Full Federal Projects, Change 31, 1 May 1998

2. Purpose. In accordance with reference a, this memorandum provides interim policy and guidance for real estate efforts associated with feasibility studies under the new Planning Paradigm, "SMART Planning," and the 3x3x3 rule. In accordance with the 3x3x3 rule, all feasibility studies should be completed within three years, at a cost of no more than $3 million, utilize three levels of vertical team coordination, and be of a "reasonable" report size.

3. Background. Real Estate has been fully engaged in the implementation of the 3x3x3 by actively participating in each webinar, the planning modernization workshop, and serving as part of the HQ Transition Team. In accordance with references b-e, Real Estate involvement is essential to the development and implementation of any pre-authorization project. Paragraph 12-16 of reference e. outlines the significant topics that must be covered in a real estate plan (REP). The level of detail necessary to apply the requirements of real estate policy and guidance will vary depending on the scope and complexity of each project.

As outlined in Chapter 12, the minimum interests in real property necessary to support various types of projects must be identified. As projects are scoped at the beginning of the feasibility phase (via a Charette or other forum), it is essential that Real Estate become familiar with the project authority and purposes to make a determination of the minimum interests and estate(s), both standard and non-standard, necessary as projects are scoped and alternatives evaluated. If a

non-standard estate will be needed, this should be discussed with MSC and HQ Real Estate as early as possible to ensure that the justification is sound and will serve the project purpose.

4. Policy. Typically, the attorney's preliminary opinion of compensability and gross appraisals are two areas that require more detail than may be readily available during the start of the feasibility phase, and are critical to determination of accurate estimates for real estate and total project costs. Due to the focus on 3 years or less for study duration, it will be essential for Real Estate to be adaptable and scale its requirements, decision making, and risk management in proportion to the significance of total project costs.

a. Gross Appraisals:

Specific to gross appraisals, EC 405-1-04 provides that cost estimates are utilized for preliminary planning of projects and in other cases, brief gross appraisals are acceptable. For purposes of the feasibility phase, the detail will vary as outlined below.

(1) For projects in which the value of real estate (lands, improvements, and severance damages) are not expected to exceed ten percent of total project costs (total cost to implement project), a cost estimate (or rough order of magnitude) will be acceptable for purposes of the feasibility phase.
(2) For projects in which the value of real estate (lands, improvements, and severance damages) do not exceed 30 percent of total project costs (total cost to implement project), a brief gross appraisal will be acceptable for purposes of the feasibility phase. A brief gross appraisal will follow format issued by Chief Appraiser.
(3) For projects in which the value of real estate (lands, improvements, and severance damages) exceed 30 percent of total project costs (total cost to implement project), a full gross appraisal will be prepared in accordance with the appraisal regulation and guidance provided by EC 405-1-04 and the Chief Appraiser.

b. Attorney's Opinion of Compensability:

As described in paragraph 12-17 of Chapter 12, utility/facility relocations may require preliminary attorney's opinions of compensability. While the practice of obtaining preliminary attorney's opinions of compensability provides a high degree of certainty with regard to project costs during the feasibility phase, such opinions can be time consuming and may provide more certainty than may be optimal for feasibility purposes when potential utility/facility relocation costs do not constitute a large percentage of total project costs. In support of the goals set out in the new planning paradigm described in reference a., Districts shall adhere to the following guidance:

(1) Where the estimated total cost to modify all project utility facility relocations, including the value of any additional lands that may be required to perform the relocations does not exceed 30 percent of estimated total project costs, the District Office of Real Estate shall, in lieu of an attorney s opinion of compensability prepare a real estate assessment. Such a real estate assessment, will address the following questions:

(a) Is the identified utility facility generally of the type eligible for compensation under the substitute facilities doctrine (e.g., school, highway, bridge, water and sewer systems, parks, etc.)
(b) Does the District have some valid data or evidence that demonstrates that it has identified an owner with a compensable interest in the property

If the answer to both questions is yes, then the District Office of Real Estate shall reflect the cost of providing a substitute facility in the Real Estate Plan (REP) and all other feasibility study cost estimates. If the answer to either or both questions is no, the District shall not reflect the cost of a substitute facility in the REP or other feasibility study cost estimates. However, the REP narrative should still include a discussion on the facility with results of analysis and project impact. For cost shared projects, the non-federal sponsor must be advised that the inclusion of substitute facilities costs in the REP or other use feasibility study estimates is for planning and budgeting purposes only and does not constitute a preliminary or final determination of compensability by the agency regardless of whether the cost of substitute facilities are reflected in the feasibility study documents. Using a real estate assessment does not eliminate the need to obtain a final attorney s opinion of compensability prior to execution of the PPA.

(2) Where the estimated total cost to modify all project facility relocations, including the value of any additional lands that may be required to perform the relocations, has public or political significance or the costs exceed 30 percent of estimated total project costs, a preliminary opinion of compensability shall be prepared for each owner s facilities. The level of documentation for each relocation item should be based on the significance of the relocation item to project formulation and estimated project costs.

Real Estate products, such as the REP, must be adaptable and scaled based on the project scope. Additionally, Real Estate must utilize the risk register to highlight areas where cost, schedule or uncertainty is greater in order to manage risk. Going forward, the Real Estate Division will continue to work closely with the Planning and Policy Division, Engineering and Construction Division, the Programs Integration Division and the National Law Firm on the Planning SmartGuide. This SmartGuide will provide more on procedures, tips, techniques and tools for

CEMP-CR
SUBJECT: Real Estate Policy Guidance Letter No. 31-Real Estate Support to Civil Works Planning Paradigm (3x3x3)

specific types of planning projects to aid in implementation of the new Planning Paradigm. All bulletins and updates on the SmartGuide can be found at: http://planning.usace.army.mil/toolbox/.

5. Duration. The policies stated herein will remain in effect until amended or rescinded by Policy Memorandums, Policy Guidance Letters, Engineers Circulars or Engineer Regulations.

FOR THE COMMANDER:

SCOTT L. WHITEFORD
DIRECTOR OF REAL ESTATE

DISTRIBUTION:
COMMANDER,
GREAT LAKES AND OHIO RIVER DIVISION (CELRD-PDS-R)
MISSISSIPPI VALLEY DIVISION (CEMVD-TD-R)
NORTH ATLANTIC DIVISION (CENAD-PD-E)
NORTHWESTERN DIVISION (CENWD-PDS)
PACIFIC OCEAN DIVISION (CEPOD-RE)
SOUTH ATLANTIC DIVISION (CESAD-PDS-R)
SOUTH PACIFIC DIVISION (CESPD-ET-R)
SOUTHWESTERN DIVISION (CESWD-ET-R)

CF:
COMMANDER,
DETROIT DISTRICT (CELRE-RE)
HUNTINGTON DISTRICT (CELRH-RE)
LOUISVILLE DISTRICT (CELRL-RE)
NASHVILLE DISTRICT (CELRN-RE)
PITTSBURGH DISTRICT (CELRP-RE)
MEMPHIS DISTRICT (CEMVM-RE)
NEW ORLEANS DISTRICT (CEMVN-RE)
ROCK ISLAND DISTRICT (CEMVR-RE)
ST. LOUIS DISTRICT (CEMVS-RE)
ST. PAUL DISTRICT (CEMVP-RE)
VICKSBURG DISTRICT (CEMVK-RE)
BALTIMORE DISTRICT (CENAB-RE)
NEW ENGLAND DISTRICT (CENAE-RE)
NEW YORK DISTRICT (CENAN-RE)
NORFOLK DISTRICT (CENAO-RE)

CEMP-CR
SUBJECT: Real Estate Policy Guidance Letter No. 31-Real Estate Support to Civil Works Planning Paradigm (3x3x3)

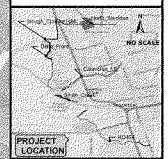
KANSAS CITY DISTRICT (CENWK-RE)
OMAHA DISTRICT (CENWO-RE)
PORTLAND DISTRICT (CENWP-RE)
SEATTLE DISTRICT (CENWS-RE)
WALLA WALLA DISTRICT (CENWW-RE)
ALASKA DISTRICT (CEPOA-RE)
HONOLULU DISTRICT (CEPOH-PP-RE)
JACKSONVILLE DISTRICT (CESAJ-RE)
MOBILE DISTRICT (CESAM-RE)
SAVANNAH DISTRICT (CESAS-RE)
ALBUQUERQUE DISTRICT (CESPA-RE)
LOS ANGELES DISTRICT (CESPL-RE)
SACRAMENTO DISTRICT (CESPK-RE)
FORT WORTH DISTRICT (CESWF-RE)
GALVESTON DISTRICT (CESWG-RE)
LITTLE ROCK DISTRICT (CESWL-RE)
TULSA DISTRICT (CESWT-RE)
CECC-R

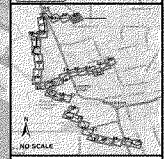
LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY
REAL ESTATE PLAN

EXHIBIT C

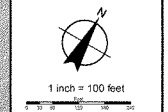
Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software and is not intended to be accepted by local government agencies and is not responsible in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the involved properties.





MARGINALIA



ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

DRAFT (<30% Design)
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OUTGRANDED / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OUTGRANDED / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OUTGRANDED / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Fed / Non-Fed)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR AREAS, SURFACE DRAWN BY USE THE FOLLOWING CONVENTIONS: U.S. ARMY FIELD MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1958.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CHECKED BY:
SAN JOAQUIN CALIFORNIA

SUBMITTED BY: STEVE J. CAREY, CHIEF CADASTRAL SECTION

RECOMMENDED BY: PAUL V. DANNO (ACTING), CHIEF, REC & ENVIR DIVISION

APPROVED BY: DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # MC

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"X34").

SHEET 01 OF 38 DRAWING NO.

ER 405-1-250 Eng. Form 1496B, Oct 81

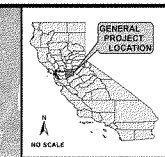
(Rev. Oct 01, 2015)

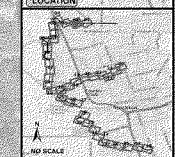
CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or in application that requires legal or engineering accuracy.
2) Parcel boundary zone is only a representation of ground features and may not be accurate. Data is compiled from various projects from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.





MARGINALIA

1 inch = 100 feet

Feet
0 50 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt.7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)

LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FED / NON-FED)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THIS MAP IS IN CONFORMITY WITH U.S. ARMY FIELD MANUAL FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CADD TECH
DESIGNED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CARTOGRAPHY AND MAPPING
RECOMMENDED BY RAUL V. ZIANNO (ACTING), CHIEF, ADD & REMT. BRANCH
APPROVED BY DIANE SIMPSON, Chief, REAL ESTATE Division
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON DC, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # MC

Date Saved: 11/13/2017 2:54:26 PM
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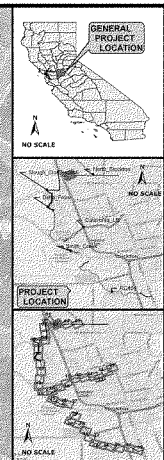
SHEET 02 of 38
DRAWING NO.

(Ver. Oct 01, 2013)

ER 405-1-106 Eng. Form 1496A, Oct 81

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this District's surface by computer software. Parcel boundaries are defined from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or recording, professional or otherwise, of the covered properties.



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OUTGRANTS / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FED / NON-FED)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR OFFICIAL SURVEYS SHOWN BELOW, THE OWNERSHIP DIAGRAMS ON U.S. ARMY FIELD Maps, PT. 11, 24, TOPOGRAPHIC SYMBOLS, DEC. 1968.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 200 300 400

Zone Data Block
NAD 1983 2011 Stateplane California III (SPS 0403 Ft US)
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt.7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20161104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SAN JOAQUIN CALIFORNIA

SUBMITTED BY
STEVE J. CAREY
CHIEF, ENGINEERING SECTION

RECOMMENDED BY
PAUL V. ZIANKO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY DANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE: CHIEF OF ENGINEERS, WASHINGTON D. C.
REIMS CODE:
REIMS UNIQUE ID:
INSTALLATION OR PROJECT # MC

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI B (22"X34")

SHEET 03 OF 38
DRAWING NO.

ER 405-1-250 Eng Form 1496A, Oct 81

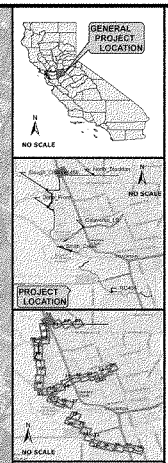
(Ver. Oct 01, 2015)

CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT adopted as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering masters.
2) Parcel boundary data is only a representation of ground features, and is not a survey. Parcel boundary data is prepared from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.



DRAFT <30% Design

As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY

USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA

COUNTY SAN JOAQUIN

DIVISION SOUTH PACIFIC DIVISION (SPD)

DISTRICT SACRAMENTO (SPK)

ARMY AREA 5TH ARMY

30 Miles S.W. OF COALINGA

OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X

FEDERAL ROADS STATE HWY XXX

AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA

FEE

PUBLIC DOMAIN { NO-DOMAIN / USE PERMIT

USE PERMIT (Other than P.D.)

TRANSFER { WITH DOMAIN / USE PERMIT

LEASE

EASEMENT RESERVED IN FEE DISPOSAL

LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA

SOLD

PUBLIC DOMAIN { NO-DOMAIN / USE PERMIT

USE PERMIT (Other than P.D.)

TRANSFERRED { Free

LEASES TERMINATED

LESSER INTERESTS TERM

REASSIGNED

ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS AROUND SLIDE AREA, SYMBOLS ARE STANDARD for U.S. ARMY TOPO MAPS, FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1993.

Federal

Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL

RE-FPLE-CLOSURE-STRUCTURE

RE-FPLE-FLOODWALL

RE-FPLE-LS

RE-FPLE-MITIGATION

RE-FPLE-WS

RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

FEET

0 25 50 75 100 150 200

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC

CAD TECH

CHECKED BY

SUBMITTED BY

STEVE J. CAREY
CHIEF, CADASTRAL SECTION

RECOMMENDED BY

PAUL V. ZIANNO (ACTING)
CHIEF, RDS & MODEL MGMT.

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION

LOWER SAN JOAQUIN RIVER

Alternative 7A

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION

DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.

REMS CODE:

REMS UNIQUE ID:

INSTALLATION OR PROJECT # MC

Date Saved: 11/13/2017 2:54:20 PM

This sheet originally formatted to ANSI D. (22"X34")

SHEET 04 OF 38

DRAWING NO.

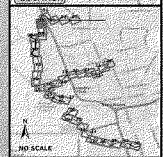
(Ver. Oct 01, 2013)

ER 405-1-12C

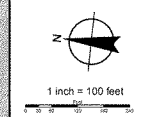
Eng. Form 1-CAD, Oct 81

Special notes:

1) This info-graphic is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface in computer mapping software. It is not an official order from local government agencies and is not mandatory in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.



MARGINALIA



ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVSION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 9TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (NET RELEASE / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (NET RELEASE / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (NET RELEASE / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Out)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL INTEREST SYMBOLS (SEE NAV CHART LEGEND), THE LEGEND IS IAW U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1959.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH.
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF TECHNICAL SECTION
RECOMMENDED BY PAUL V. ZIANO (ACTING), CHIEF, RES & REAL ESTATE DIVISION
APPROVED BY DANE SIMPSON, CHIEF, REAL ESTATE DIVISION
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE: CHIEF OF ENGINEERS, WASHINGTON DC, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # Shima

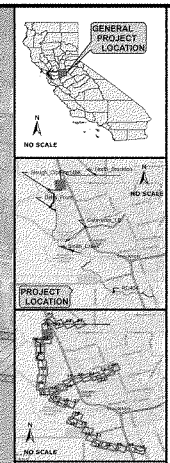
Date Saved: 11/13/2017 2:54:20 PM
No year-specific transfer to AME 8 (F32)

SHEET 05 OF 38 DRAWING NO.

(Ver. Oct 01, 2013) ER 405-1-200 Enj_Form 1450G, Oct 81

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering services.
2) Parcel boundary data is only a representation of general ownership information. Parcel boundary information is proprietary from tax data obtained from local government agencies and is not concurrently in whole, or in part, tested upon any physical survey, state, or recording, professional or otherwise, of the covered properties.



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { WITHDRAWN / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENCE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { DEDICATED / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { FED / NON-FED
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARDIZED IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

FEET
0 50 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Feet
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet
SPC Zone: CA_III_FIPS_0403_Feet

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CAD TOPOGRAPHER SJC
CAD TO TECS
CHECKED BY
SUBMITTED BY
STEVE J. CAREY
CHIEF, CADASTRAL SECTION
RECOMMENDED BY
PAUL V. ZANNO (ACTING)
CHIEF, REAL ESTATE DIVISION
APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25 D.C.
REMIS CODE:
REMIS UNIQUE ID:
DISTRIBUTION OR PROJECT # Shima

Date Saved: 11/13/2017 2:04:20 PM
This sheet originally finaled to ARB B, 2/2/14

SHEET 06 OF 38 DRAWING NO.

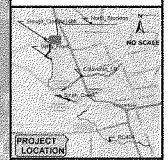
(Ver. Oct 01, 2012) ER 405-1-12 Exp. Form 1434A, Oct 84

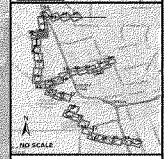
CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of general features expected on the Earth's surface by computer software and is based on data obtained from local government agencies and is not accurate in whole, or in part, based upon any physical survey, state, or recording, professional or otherwise, of the covered properties.





MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 200 300 400

Data Date:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OUTGRANTS / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (GSA)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW, THE SYMBOLOGY CONFORMS TO U.S. ARMY FIELD MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1968.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SAN JOAQUIN
CALIFORNIA

SUBMITTED BY
STEVE J. CAREY
CHIEF, CARTOGRAPHY SECTION

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY
PAUL V. DANNO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY
DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION

DATE

OFFICE: CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

Date Saved: 11/13/2017 2:54:20 PM
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SHEET 07 OF 38
DRAWING NO.

ER 405-1-250
Eng Form 1496A, Oct 81

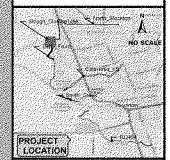
(Ver. Oct 01, 2013)

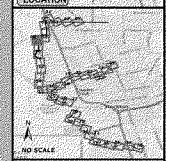
CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering science.
2) Parcel boundary data is only a representation of ground conditions and is based on a variety of data collection programs from over data obtained from local government agencies and in part necessarily in whole, or in part, based upon any physical survey, made, or requiring, professional or otherwise, of the covered properties.





MARGINALIA

1 inch = 100 feet

Feet
0 50 0 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 FT US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design

As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { OUTGRANTS / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { OUTGRANTS / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { FDA
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARD TO U.S. ARMY TOPO MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1966

Federal

Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
DRAFT'D BY
CHECKED BY
SUBMITTED BY
STEVE J. CAREY
CHIEF, CARTOGRAPHIC SECTION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY
PAUL V. ZANNO (ACTING)
CHIEF, REG & PROP. DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION

DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

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PAGE 08 OF 38 DRAWING NO.

(Ver. Oct 01, 2015)

ER 405-1-200 Eng_Form 5436A, Oct 81

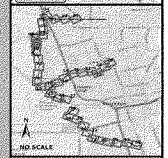
710

CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software. Data has been obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.



MARGINALIA

1 inch = 100 feet

Scale
0 50 25 125 100 200 300

Date Data Set:
NAD 1983 2011 StatePlane California III (FIPS 0403) FT US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternativ7a-Levee Footprints_20161104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (To)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW, MAP SYMBOLS ARE STANDARD PER U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1966

Federal
Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CARTHED BY:
SUBMITTED BY: STEVE J. CAREY, CHIEF TECHNICAL SECTION
RECOMMENDED BY: PAUL V. ZANNO (ACTING), CHIEF, ADC & REAL ESTATE DIVISION
APPROVED BY: DIANE SHEPSON, CHIEF, REAL ESTATE DIVISION
DATE

SAN JOAQUIN — CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

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SHEET 09 OF 38 DRAWING NO.

ER 405-1-200 Eng_Form 1495A, Oct 82

(Ver. Oct 01, 2012)

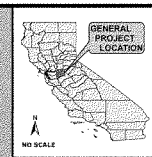
711

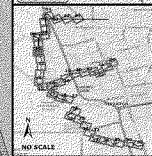
CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground measurements and is not intended to be a legal document. Data prepared from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or recording, geographical or otherwise, of the covered properties.





DRAFT <38% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { WITHDRAWN / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENCE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { DESIGNATED / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { CITY
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THIS SYMBOL ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1965.

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

0 50 25 50 100 150 FEET

Coordinate System:
NAD 1983 2011 StatePlane California IX FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG,

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CAD VS. MDV
DESIGNED BY
SUBMITTED BY
STEVE J. CAREY
CHIEF, CADASTRAL SECTION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY
PAUL V. ZIANNO (ACTING)
CHIEF, R/E & PROJ. MGMT. BRANCH

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICIAL CHIEF OF ENGINEERS, WASHINGTON, D. C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

Date Saved: 11/13/2017 2:04:20 PM
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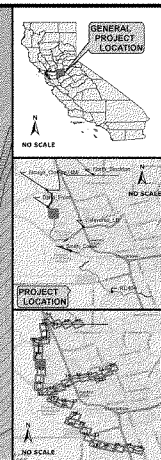
SHEET 10 OF 38
DRAWING NO.

(Ver. Oct 01, 2015)

ER 405-1-205

Reg. Form 1426A, Oct 84



MARGINALIA

1 inch = 100 feet

Feet
0 50 100 200 300 400

Date Plot Made
NAD 1983 2011 Geodetic California ZII FIPS 0402 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20161104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (EASEMENTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (EASEMENTS / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (EASEMENTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FEE)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR MAPS, SYMBOLS DATUMS BLUE BOOK, SPECIFICATIONS, TOPOGRAPHIC ON U.S. ARMY FIELD MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1959.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CHECKED BY:
SUBMITTED BY STEVE J CAREY
CHIEF, CARTOGRAPHIC SECTION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY PAUL V. ZANNO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

Date Saved: 11/13/2017 2:54:20 PM
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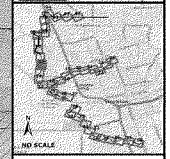
SHEET 11 OF 38 DRAWING NO.

ER 405-1-1200 Eng_Form 1426A, OCT 81

(Ver. Oct 01, 2015)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering science.
2) Parcel boundary zone is only a representation of ground measurements and is not a legal survey. Information and programs from our data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or recording, professional or otherwise, of the covered properties.



MARGINALIA

N

1 inch = 100 feet

Feet
0 35 65 130 195 260

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20180108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20191104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (NO DOMAIN / USE PERMIT)
USE PERMIT (Other Than P.D.)
TRANSFER (WITH DOMAIN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITH DOMAIN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Free)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS AROUND BELOW NOT OFFICIAL APPROVED CONFORMED TO U.S. ARMY TITLE PAMPHLET 405-24 TOPOGRAPHIC SYMBOLS, DEC. 1955.

Federal
Non-Fed
Takes_All_LSJR
RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC	SAN JOAQUIN	CALIFORNIA
CAD TECH	REAL ESTATE DIVISION	
CHECKED BY	LOWER SAN JOAQUIN RIVER	
SUBMITTED BY STEVE J. CAREY, CHIEF, CONTINUING PLANNING	Alternative 7A	
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, REAL ESTATE DIVISION	APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION	DATE
OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.	Date Saved: 11/13/2017 2:54:20 PM	
REMS CODE:	This sheet manually formatted to ANSI D. (22"X34")	
REMS UNIQUE ID:		
INSTALLATION OR PROJECT # 14M	SHEET 12 OF 38	DRAWING NO.

(Ver. Oct 01, 2013)

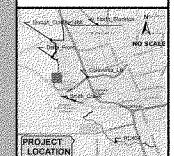
ER 405-1-12 Eng. Form 1-ENG, Oct 81

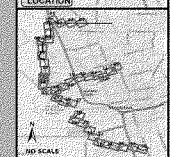
CORPS OF ENGINEERS

U.S. ARMY

Special notice:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an applicatnt that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software and is not intended to be used as a legal document. Appendix and is not necessarily in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.





MARGINALIA

1 inch = 100 feet

Feet
0 30 60 120 180 240

Coordinate Data:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Fee)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL INTEREST SYMBOLS SHOWN ON MAP CONFORM TO CURRENT VERSION OF U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1990.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLS

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY
CHIEF, TECHNICAL SECTION
RECOMMENDED BY PAUL V. DANKO (ACTING)
CHIEF, REC & LEGAL DIVISION
OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON DATE
CHIEF, REAL ESTATE DIVISION

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"X34")

SHEET 13 OF 38 DRAWING NO.

(Ver. Oct 01, 2015)

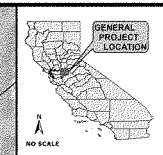
ER 405-1-1500 ENG Form 1564A, Oct 81

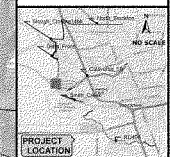
CORPS OF ENGINEERS

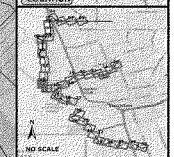
U.S. ARMY

Special notes:

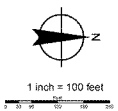
1) This information is NOT intended as a substitute for a field survey by a licensed professional, or in application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground control information and is derived from various mapping programs from non-first-order/real time local government agencies and is not automatically in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.







MARGINALIA



ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE: ARMY
USING SERVICE: U.S. ARMY

LOCATION OF PROJECT

STATE: CALIFORNIA
COUNTY: SAN JOAQUIN
DIVISION: SOUTH PACIFIC DIVISION (SPD)
DISTRICT: SACRAMENTO (SPK)
ARMY AREA: 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS: US HWY X
FEDERAL ROADS: STATE HWY XXX
AIRPORTS: XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED: NO AREA
FEE
PUBLIC DOMAIN: CATEGORICAL / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER: WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS: REASSIGNED / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED: NO AREA
SOLD
PUBLIC DOMAIN: CATEGORICAL / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED: FEE
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1959.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER: SJC
CAD'D TECH:
CHECKED BY:
SUBMITTED BY: STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY: PAUL V. ZANNO (ACTING), CHIEF, ADS & RIGHT-WAY
APPROVED BY: DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION
DATE:

SAN JOAQUIN — CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT #: 14M

Date Saved: 11/13/2017 2:54:20 PM
"This sheet originally formatted to ANSI B (22"x34")"

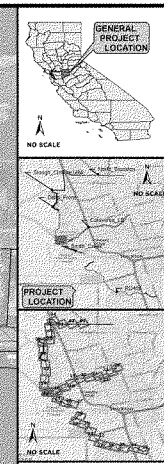
SHEET: 14 OF 38
DRAWING NO.

(Ver. Oct 01, 2015)

ER 405-1-200 Eng. Form 1484, Oct 81

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this district's surface by computer software. Parcel data is not considered true local government agencies and is not necessarily in whole, or in part, based upon the physical survey, deed, or recording, professional or otherwise, of the covered properties.



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OWNERSHIP / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (OWNERSHIP / USE PERMIT)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

MARGINALIA

N

1 inch = 100 feet

Feet
0 30 60 120 180 240

Date Made: 11/13/2017
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created using ED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

LEGEND

EXCEPT FOR MINOR SYMBOLS SHOWN BELOW, THE CHARACTER OF SYMBOLS IN U.S. ARMY FIELD MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1968.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SUBMITTED BY STEVE J CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. DANRO (ACTING), CHIEF, ROD & REAL ESTATE
OFFICE: CHIEF OF ENGINEERS, WASHINGTON DC, D.C.
REVIEW CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # 14M

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

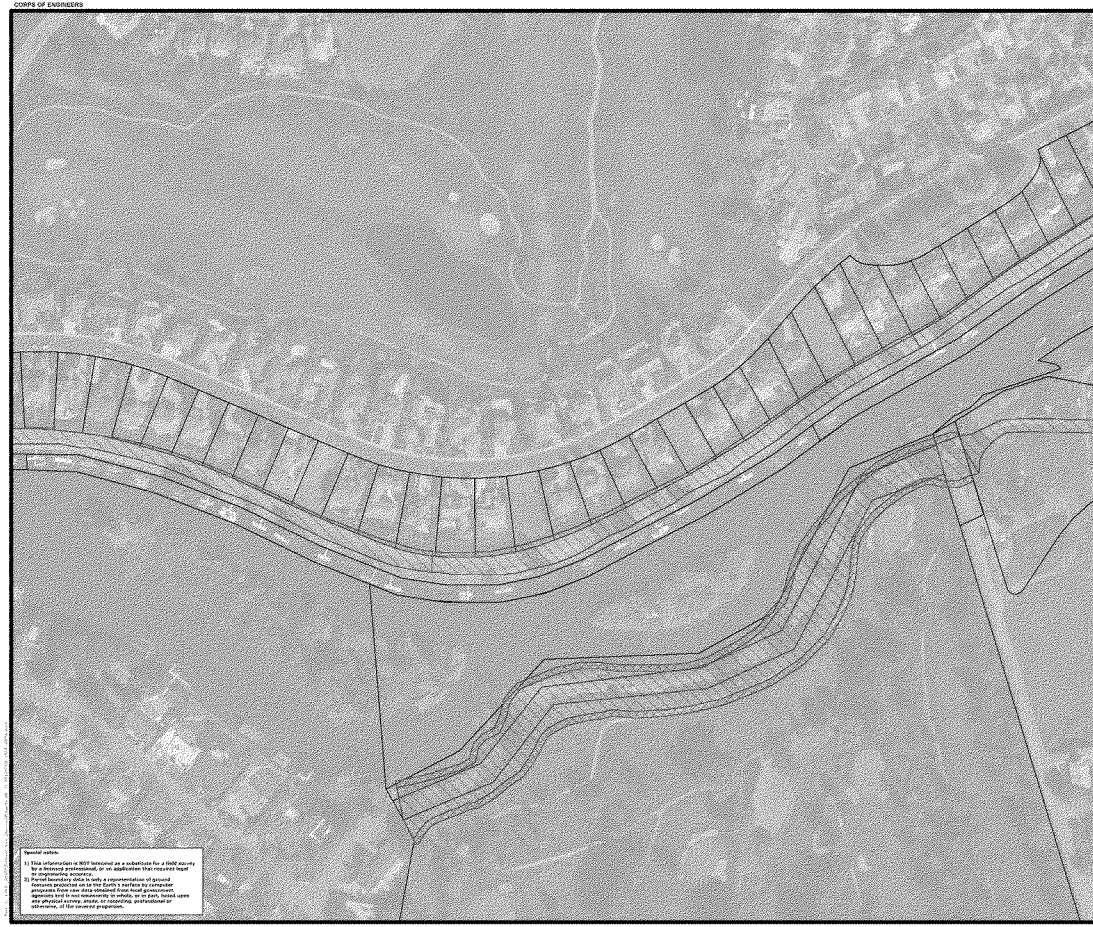
APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted in ANSI B (22"X34")

SHEET 15 OF 38 DRAWING NO.

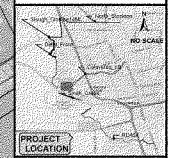
ER 405-1-250 Eng Form 1496A, Oct 81

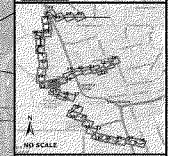
(Ver. Oct 01, 2015)



Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground measurements and is based on the best available information prepared from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or competing, professional or otherwise, of the covered properties.





MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG,

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN: OETHERWAY / USE PERMIT
USE PERMIT (Other than PD.)
TRANSFER: NPI HOWAY / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS: EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN: OEXCHANGE / USE PERMIT
USE PERMIT (Other than PD.)
TRANSFERRED: FOG / OTHER
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN SELOW THESE SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31 "TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CADD TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF CADASTRAL SECTION
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, R/E & PROJ. MGMT. BRANCH

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

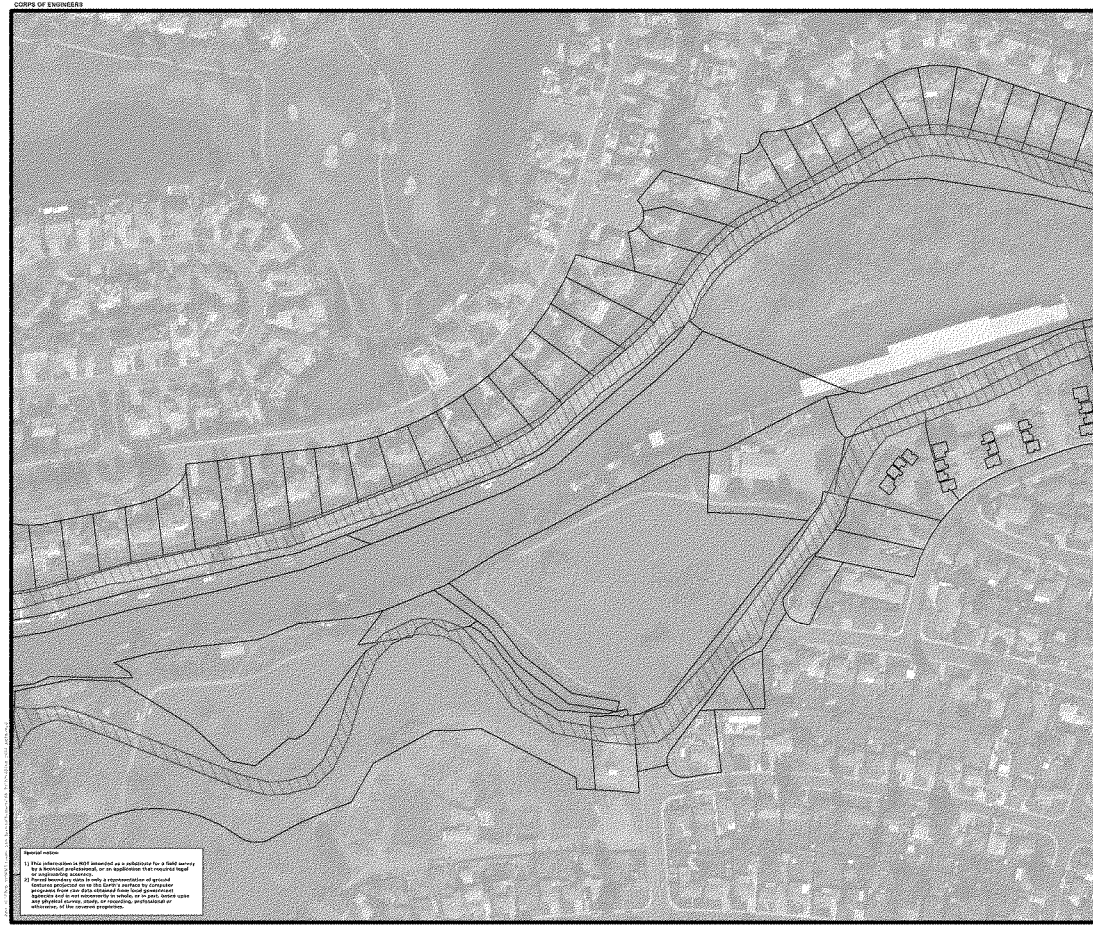
APPROVED BY DIANE SIMPSON, CHIEF, R/E DIVISION DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT: Calaveras

Date Saved: 11/13/2017 2:04:20 PM
This sheet originally formatted to ANSI D (22"X34")

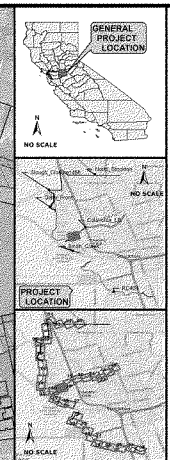
SHEET 16 of 38 DRAWING NO.

(Ver. Oct 01, 2013) ER 405-1-250 Eng. Form 1496A, Oct 81



Special notice:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, preliminary or otherwise, of the concerned properties.



DRAFT (<30% Design)
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (DEPARTURE / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (DEPARTURE / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (DEPARTURE / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (To)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR MEDIA, SUBSOILS DIGGER, SILLING, MAP DATABASE, CARGRAPHY 2F U.S. ARMY FIELD MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1958.

Federal
Non-Fed
Takes_All_LSJR
RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

Feet
0 50 25 125 250 375

Date Made
NAD 1983 2011 StatePlane California ZZ (FIPS 0402 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH.
CHECKED BY
SAN JOAQUIN CALIFORNIA

SUBMITTED BY
STEVE J. CAREY
CHIEF, ENGINEERING SECTION

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY
PAUL V. ZIANO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICE: CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # Calaveras

Date Saved: 11/13/2017 2:54:20 PM
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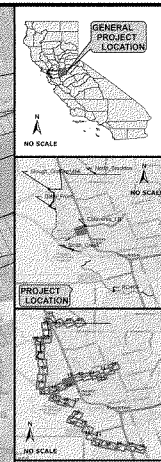
SHEET 17 OF 38
DRAWING NO.

(Ver. Oct 01, 2012) ER 405-1-250 Eng. Form 1496B, Oct 81



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { HO+DOMAIN / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITH DOMAIN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { DOT+DOMAIN / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { Fed / Non-Fed
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS AROUND RECORD NO-OF-WAYS, ARE COMPRISED OF U.S. ARMY TOPO MAPS, PP 21 & "TOPOGRAPHIC SYMBOLS, DEC. 1955.

Federal
Non-Fed
Takes_All_LSJR
RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

0 50 100 200 300 400 500

Coordinate System:
NAD 1983 2011 Amstrong California 101 (US) 0402 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CADD TECH
CHECKED BY
SUBMITTED BY
STEVE J. CAREY
CHIEF, ENGINEERING SECTION
RECOMMENDED BY
PAUL V. ZIANNO (ACTING)
CHIEF, RDS & REAL ESTATE DIVISION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # Calaveras

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D, 22"X34".

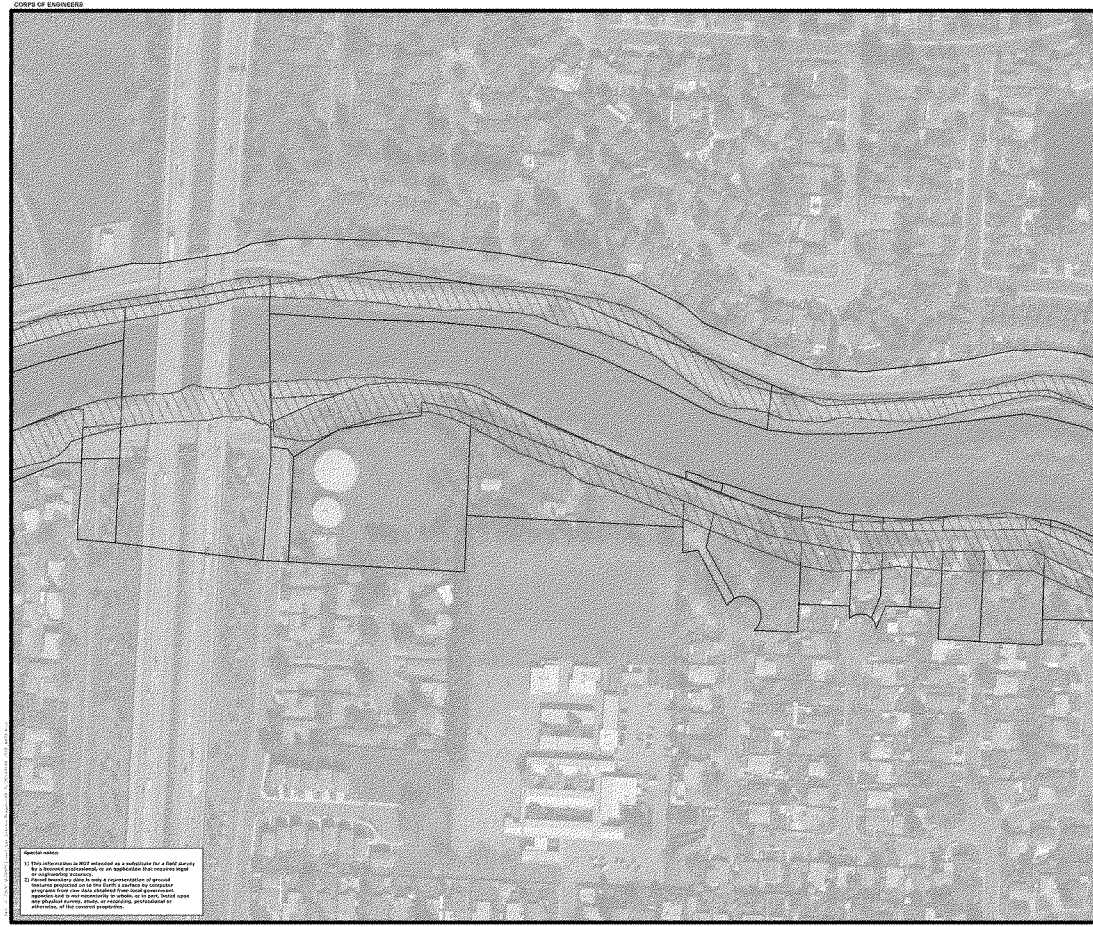
SHEET 18 OF 38 DRAWING NO.

(Ver. Oct 01, 2015)

ER 405-1-200 Eng. Form 1-CAD, Oct 81

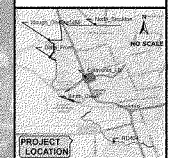
CORPS OF ENGINEERS

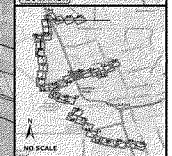
U.S. ARMY



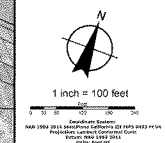
Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software. Data is not shaded from local topographical appendes but is not necessarily in whole, or in part, based upon any physical survey, study, or mapping, perpendicular or otherwise, of the covered properties.





MARGINALIA



ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 4TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OWNERSHIP / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEN INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Exc.)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

(EXCEPT FOR METAL SHAPES & DATUMS BELOW, MAP SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, SEC. 1303.

Federal
Non-Fed
Takes_All_LSJR
RE-FPLE/CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SAN JOAQUIN
CALIFORNIA

SUBMITTED BY
STEVE J. CAREY
CHIEF, TECHNICAL SECTION

RECOMMENDED BY
PAUL V. CANNO (ACTING)
CHIEF, REC & REAL ESTATE DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICIAL CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # Calaveras

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"X34")

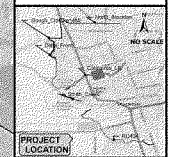
SHEET 19 OF 38
DRAWING NO.

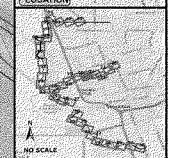
ER 405-1-250
Eng Form 1558b, Oct 81

(Ver. Oct 01, 2015)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features based on data from various sources. Information prepared from raw data obtained from local government agencies and in part uncertainly in whole, or in part, based upon any physical survey, study, or reporting, professional or otherwise, of the covered properties.





MARGINALIA

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternativ7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE: ARMY
USING SERVICE: U.S. ARMY

LOCATION OF PROJECT

STATE: CALIFORNIA
COUNTY: SAN JOAQUIN
DIVISION: SOUTH PACIFIC DIVISION (SPD)
DISTRICT: SACRAMENTO (SPK)
ARMY AREA: 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS: US HWY X
FEDERAL ROADS: STATE HWY XXX
AIRPORTS: XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED: NO AREA
FEE
PUBLIC DOMAIN: (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER: (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS: (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED: NO AREA
SOLD
PUBLIC DOMAIN: (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED: (FEE /)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS NOTED BELOW, THESE SYMBOLS ARE STANDARD IN U.S. ARMY RIDS MANUAL, FY 2 1 0 TOPOGRAPHIC SYMBOLS, DEC. 1993

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER: SJC
CHECKED BY:
SUBMITTED BY: STEVE J. CAREY, CHIEF CADASTRAL SECTION
RECOMMENDED BY: PAUL V. ZIANNO (ACTING), CHIEF, RDS & RIGHT WARDEN
OFFICE, CHIEF OF ENGINEERS, WASHINGTON DC, D.C.
RIMS CODE:
RIMS UNIQUE ID:
INSTALLATION OR PROJECT #: Calaveras

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY: DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE:

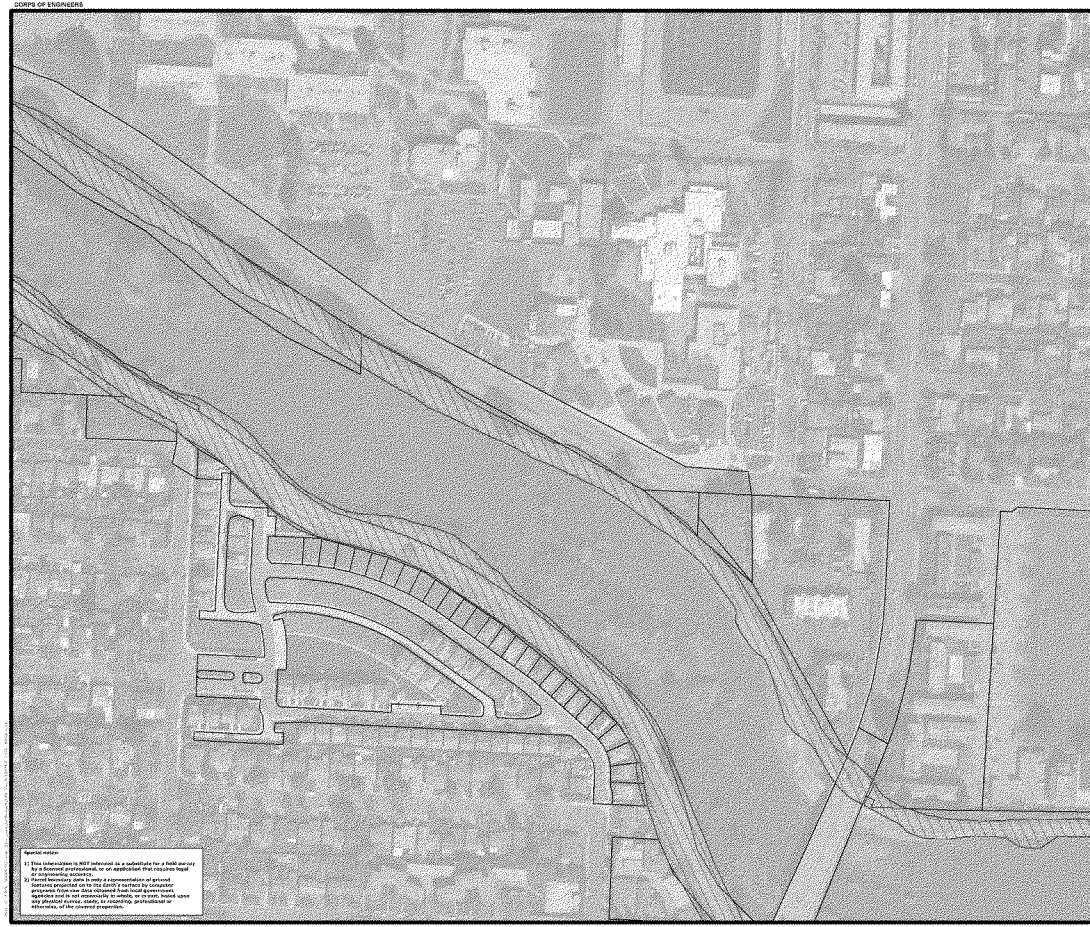
Date Saved: 11/13/2017 2:54:20 PM
This sheet prepared/ formatted in ARB: D. 17.2TC

SHEET 20 OF 38 DRAWING NO.

(Rev. Oct 01, 2015) ER 405-1-200 Eng. Form 1496A, Oct 81

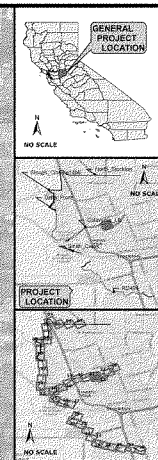
CORPS OF ENGINEERS

U.S. ARMY



Special notice

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an applicant that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this earth's surface by computer software. Parcel boundary data is obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.



MARGINALIA

N

1 inch = 100 feet

Feet
0 50 25 125 250 500

Date Date Date
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 4TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OUTGRANT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OUTGRANT / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEN INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OUTGRANT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Exc.)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR MEDIA, SURFACE WATER, SIGNS, MAP TOPICS, AND STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. DANKO (ACTING), CHIEF, ADD & LEASE BRANCH
OFFICE, CHIEF OF ENGINEERS, WASHINGTON, D.C.
REMIS CODE
REMIS UNIQUE ID:
INSTALLATION OR PROJECT: Calaveras

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

Date Saved: 11/13/2017 2:54:20 PM
For use originally formatted in AME 8.0"2X"

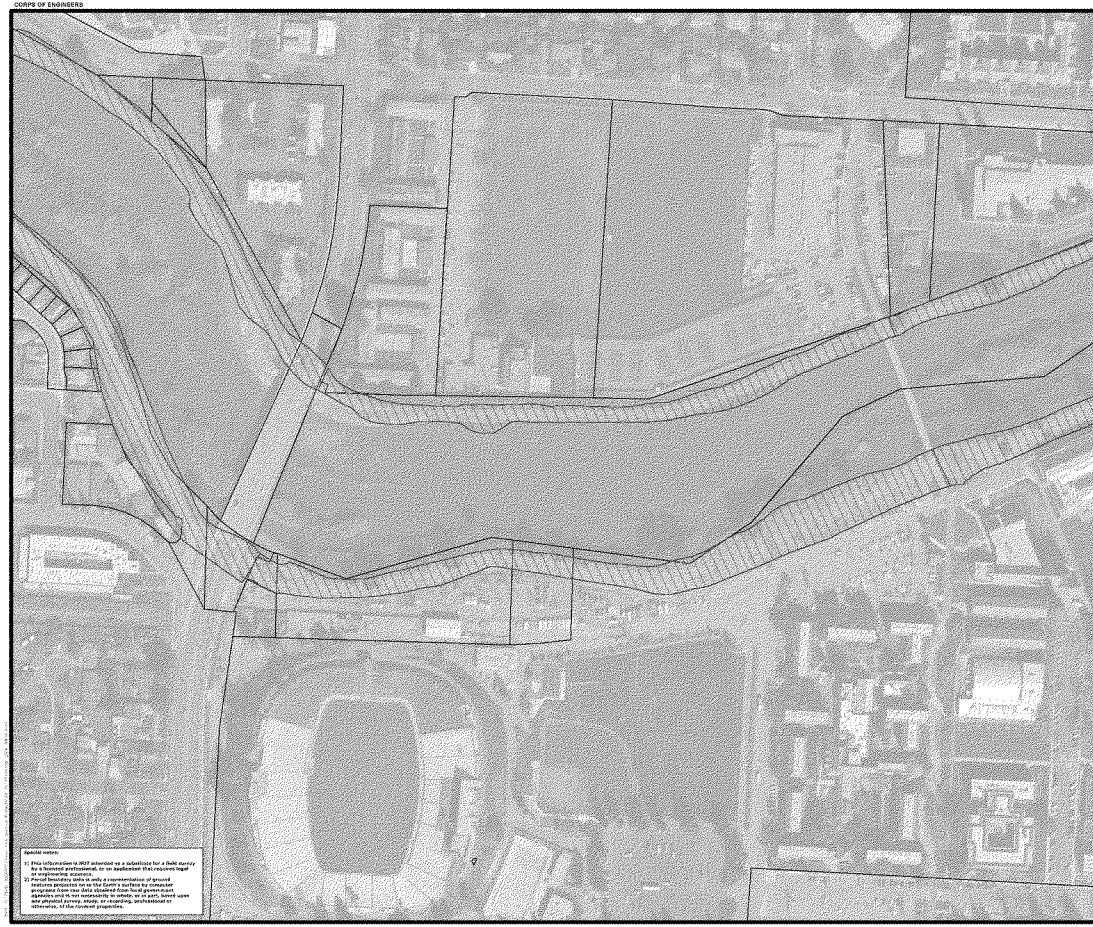
SHEET 21 of 38 DRAWING NO.

(Ver. Oct 01, 2015)

DR 425-1-250 Eng Form 1558b, Oct 81

CORPS OF ENGINEERS

U.S. ARMY



Special notes:

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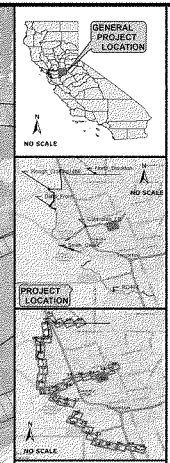


DRAFT <30% Design

As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY

USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA

COUNTY SAN JOAQUIN

DIVISION SOUTH PACIFIC DIVISION (SPD)

DISTRICT SACRAMENTO (SPK)

ARMY AREA 8TH ARMY

30 Miles S.W. OF COALINGA

OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X

FEDERAL ROADS STATE HWY XXX

AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA

FEE

PUBLIC DOMAIN { OUTGRANTS / USE PERMIT

USE PERMIT (Other than P.D.)

TRANSFER { WITHDRAWN / USE PERMIT

LEASE

EASEMENT RESERVED IN FEE DISPOSAL

LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA

SOLD

PUBLIC DOMAIN { OUTGRANTS / USE PERMIT

USE PERMIT (Other than P.D.)

TRANSFERRED { FEDERAL

LEASES TERMINATED

LESSER INTERESTS TERM

REASSIGNED

ACRES TO

LEGEND

LEGEND FOR SPECIAL SYMBOLS SHOWN BELOW MAY BE FOUND IN ACCORDANCE TO U.S. ARMY TOPO MANUAL, FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1966

Federal

Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL

RE-FPLE-CLOSURE-STRUCTURE

RE-FPLE-FLOODWALL

RE-FPLE-LS

RE-FPLE-MITIGATION

RE-FPLE-WS

RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

Feet

0 50 0 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC

CARTO TECH

CHECKED BY

SUBMITTED BY

STEVE J. CAREY
CHIEF, CARTOGRAPHIC SECTION

RECOMMENDED BY

PAUL V. ZIANNO (ACTING)
CHIEF, R/E & RELOCATIONS DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION

DATE

SAN JOAQUIN

CALIFORNIA

REAL ESTATE DIVISION

LOWER SAN JOAQUIN RIVER

Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.

REMS CODE:

REMS UNIQUE ID:

INSTALLATION OR PROJECT: Calaveras

Date Saved: 11/13/2017 2:54:26 PM

This sheet originally formatted to ANSI D (22"X34")

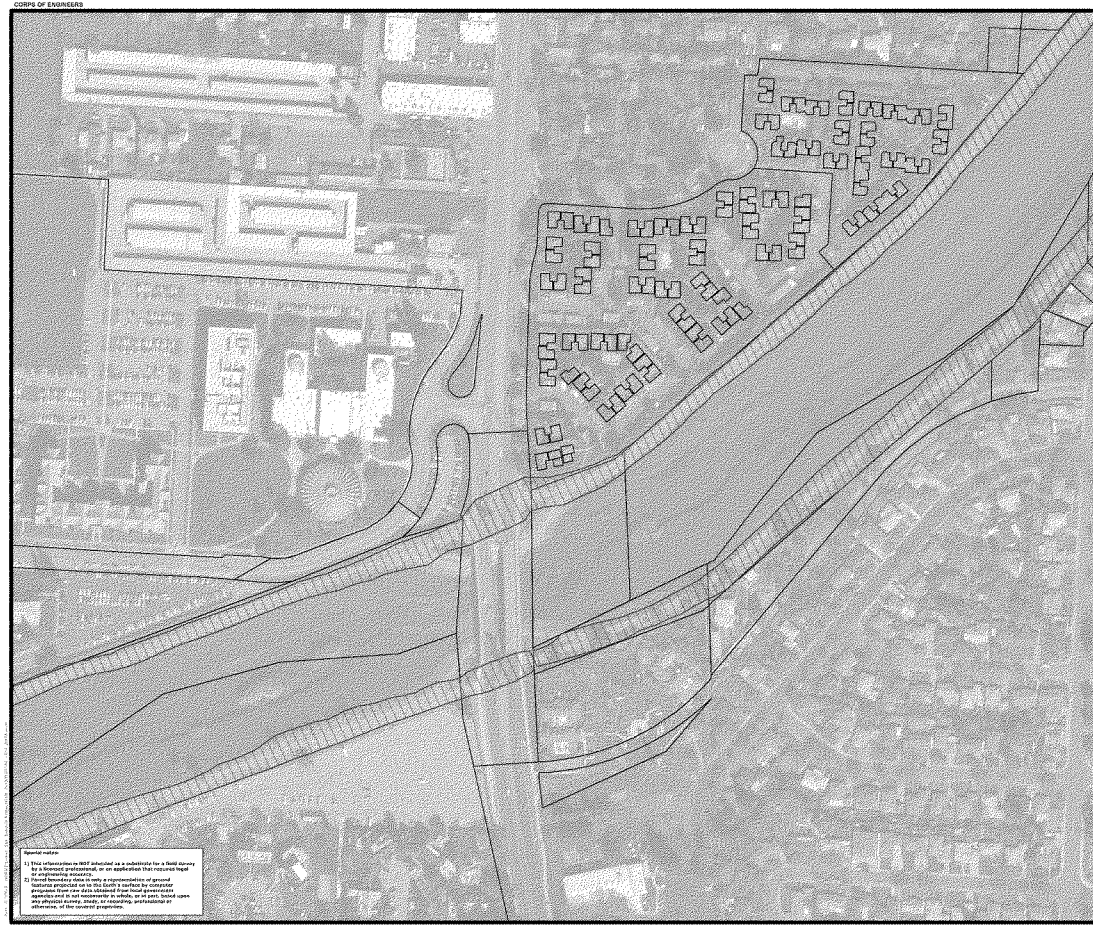
SHEET 22 OF 38

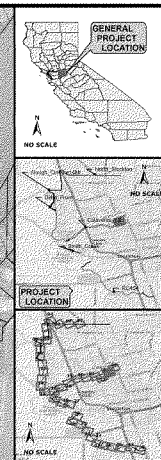
DRAWING NO.

ER 405-1-200

Reg_Form 5436A, Oct 81

(Rev. Oct 01, 2015)





DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (EXTINGUISHMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (EXTINGUISHMENT / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (EXTINGUISHMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FEE / LEASE)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

(EXCEPT FOR MAPS, SYMBOLS SHOWN BELOW MAY DIFFER FROM THOSE ON U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1983.

- Federal
- Non-Fed
- Takes_All_LSJR
- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

Scale 1:1200
0 50 25 100 200 300
Coordinate System:
NAD 1983 2011 StatePlane California III (FIPS 0403) Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
CHECKED BY
SAN JOAQUIN CALIFORNIA

SUBMITTED BY STEVE J. CAREY
CHIEF, LEASING SECTION

RECOMMENDED BY PAUL V. ZIANNO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE: CHIEF OF ENGINEERS, WASHINGTON D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # Calaveras

Date Saved: 11/13/2017 2:54:20 PM
(to show correctly formatted in ARB 8.17/2)

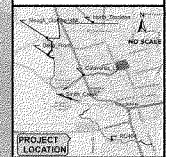
SHEET 23 OF 38
DRAWING NO.

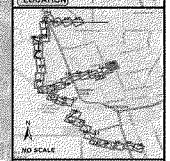
ER 405-1-250 Eng_Form (JUN 1978)

(Ver. Oct 01, 2013)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Partial boundary sizes in only a representation of ground measurements taken from GPS, aerial photo, and mapping programs from one date obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or competing, professional or otherwise, of the covered properties.





DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { OWTHGRANT / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITHGRANT / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { NO GRANT / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { FTS / ETC
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

MARGINALIA

N

1 inch = 100 feet

Feet
0 50 25 0 50 100 200

Coordinate System:
NAD 1983 2011 StatePlane California III (FIPS 0403) FF US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1968.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG,

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER GIC
CADD REV.
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, REAL ESTATE SECTION
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, RED & PERT. BRANCH
APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # Calaveras

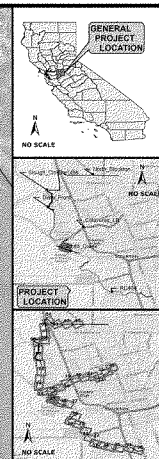
Date Saved: 11/13/2017 2:54:20 PM
This sheet originally finished to ANSI D (22"X34").

SHEET 24 OF 38 DRAWING NO.

(Ver. Oct 01, 2015) ER 405-1-250 Eng. Form 1494A, Oct 61

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this District's surface to computer aided drafting (CAD) standards based over local government agencies and is not necessarily in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 4TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OVERBURDEN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OVERBURDEN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OVERBURDEN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Exc.)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

(EXCEPT FOR METAL SURFACE DATUM BY USE MAP SYMBOLS AND STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

0 50 100 200 300 400 (Feet)

Zone Data:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20191104.DWG.

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC SAN JOAQUIN CALIFORNIA
CARTO TECH:
CHECKED BY:
SUBMITTED BY STEVE J CAREY CHIEF, CARTOGRAPHIC SECTION
RECOMMENDED BY PAUL V. DIANO (ACTING) CHIEF, REAL ESTATE DIVISION
APPROVED BY DIANE SIMPSON CHIEF, REAL ESTATE DIVISION DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
RIBBS CODE:
REMS UNIQUE ID:
ReSOLICITATION NR PROJECT # SJR

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"x34")

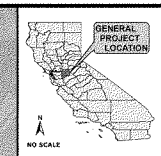
SHEET 25 OF 38 DRAWING NO.

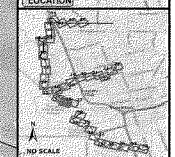
SR 425-1-250 Eng Form 1558b, Oct 81

(Ver. Oct 01, 2015)

Special notes:

1) This information is NOT intended as a substitute for a field survey to be licensed professional, or an application that requires legal or engineering science.
2) Parcel boundary data is only a representation of ground measurements and is not a survey. Data was compiled from programs from use data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, tests, or recording, performed or otherwise, of the covered properties.





MARGINALIA

1 inch = 100 feet

Feet
0 50 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III (US) FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENCE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (DESIGNATED / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FFV / ...)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW, MAP SYMBOLS ARE STANDARDIZED IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1965.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

DRAFTSMAN/PREP SJC
CHK'D TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, RDS & REAL ESTATE DIVISION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

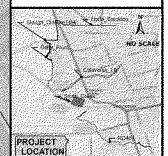
Date Saved: 11/13/2017 2:04:20 PM
This sheet originally designed to ARM 8.27/14

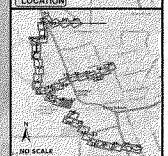
SHEET 26 of 38 DRAWING NO.

(Ver. Oct 01, 2012) ER 405-1-200 Reg. Form 1484A, Oct 84

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software. Parcel boundaries are determined by local government agencies and is not necessarily in whole, or in part, based upon any physical survey, audit, re-recording, prefabrication or otherwise, of the involved properties.





MARGINALIA

N

1 inch = 100 feet

0 50 100 200 300 400

Date Saved:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OUTGRANTS / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OUTGRANTS / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (GSA / DOD)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN ON THIS MAP (PROPERTY OWNERSHIP) IN U.S. ARMY FIELD Manual, FM 21-26 TOPOGRAPHIC SYMBOLS, DEC. 1968.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CHECKED BY:
SAN JOAQUIN
CALIFORNIA

SUBMITTED BY
STEVE J. CAREY
CHIEF, CADASTRAL SECTION

RECOMMENDED BY
PAUL V. DANNO (ACTING)
CHIEF, RES & ACQUIS BRANCH

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

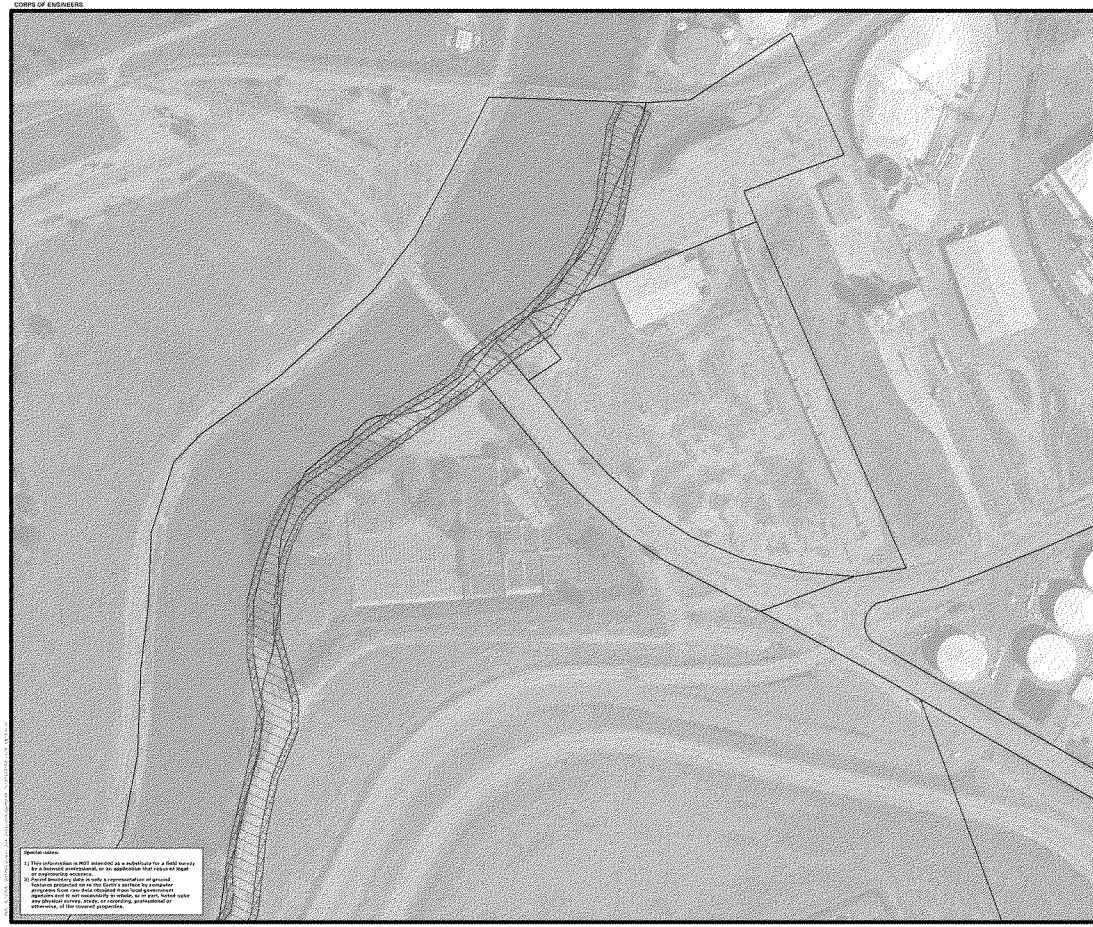
OFFICE, CHIEF OF ENGINEERS, WASHINGTON DC D.O.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI B (22"X34")

SHEET 27 OF 38
DRAWING NO.

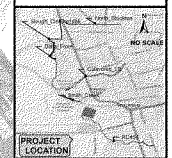
ER 405-1-250
Eng_Form 1496A, Oct 81

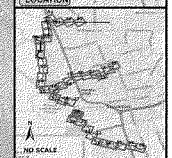
(Ver. Oct 01, 2015)



Special notes:

1) This information is NOT intended as a substitute for a field survey or a licensed surveyor, or an application that required legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground measurements and is based on a variety of data collection programs from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or computing, geotechnical or otherwise, of the covered properties.





MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 200 300 400

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Feet US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt7a-LeveeFootprints_20161221.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design

An Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { OUTGRANTS / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { VETO GRANTS / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { OUTGRANTS / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { FEDERAL
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS NOTED BELOW THE OFFICIAL SYMBOLS CONTAINED IN U.S. ARMY FIELD MANUAL, FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1955

Federal

Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL

RE-FPLE-CLOSURE-STRUCTURE

RE-FPLE-FLOODWALL

RE-FPLE-I-S

RE-FPLE-MITIGATION

RE-FPLE-WS

RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CHECKED BY
SUBMITTED BY
STEVE J. CAREY
CHIEF, CADASTRAL SECTION
RECOMMENDED BY
PAUL V. ZIANNO (ACTING)
CHIEF, REG & RIGHT WEBSCH

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICE CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

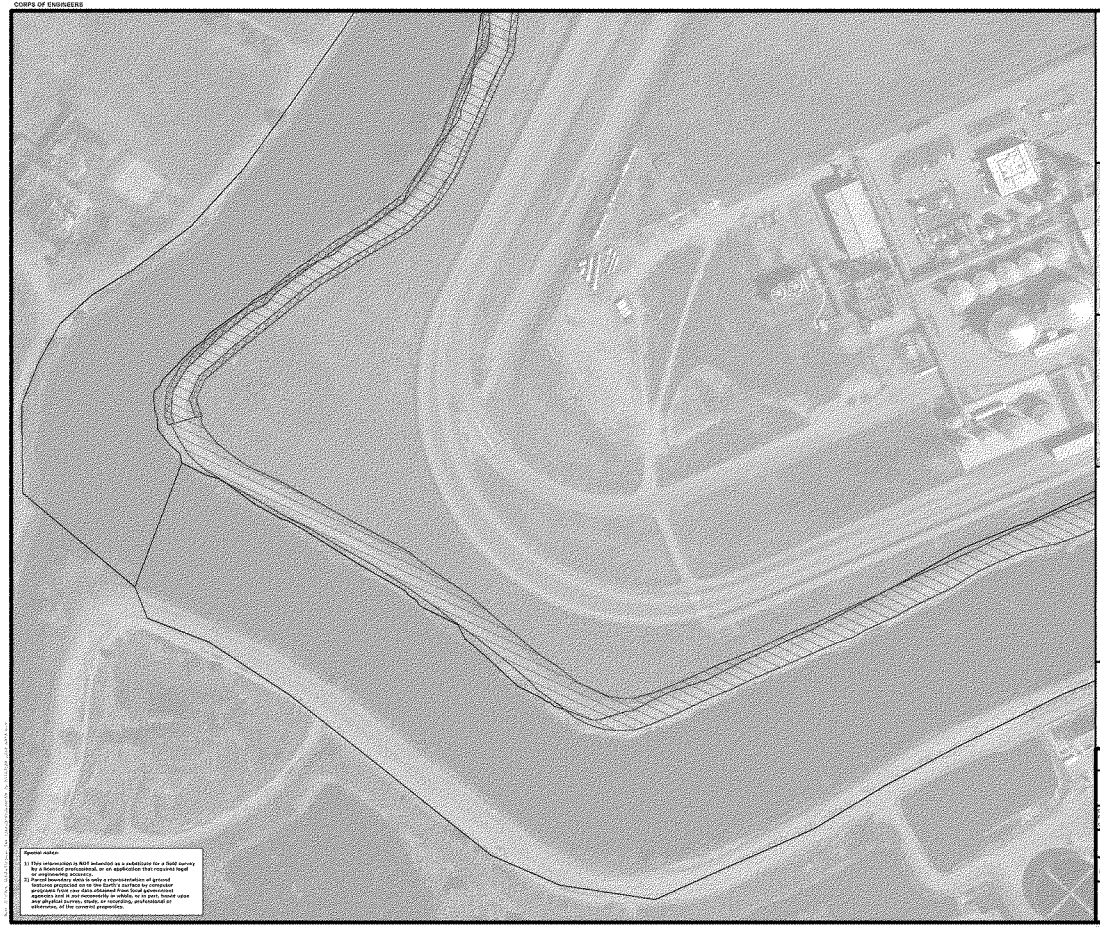
Date Saved: 11/13/2017 2:54:20 PM
This sheet originally designed to ANSI D (22"X34")

SHEET 28 of 38 DRAWING NO.

(Rev. Oct 01, 2015) ER 405-1-200 Eng. Form 1496A, Oct 81

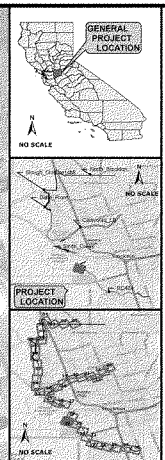
CORPS OF ENGINEERS

U.S. ARMY



Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to the Earth's surface by computer software. Data has been obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the referred properties.



MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 125 150 200

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 4TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (OWNERSHIP / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (OWNERSHIP / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (Fed / Non-Fed)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR MEDIA, SYMBOLS DATUMS, BLUE, MAP TOPICS, AND CONFORMITY IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CAD/TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. DANKO (ACTING), CHIEF, REC. & CORP. SECTION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

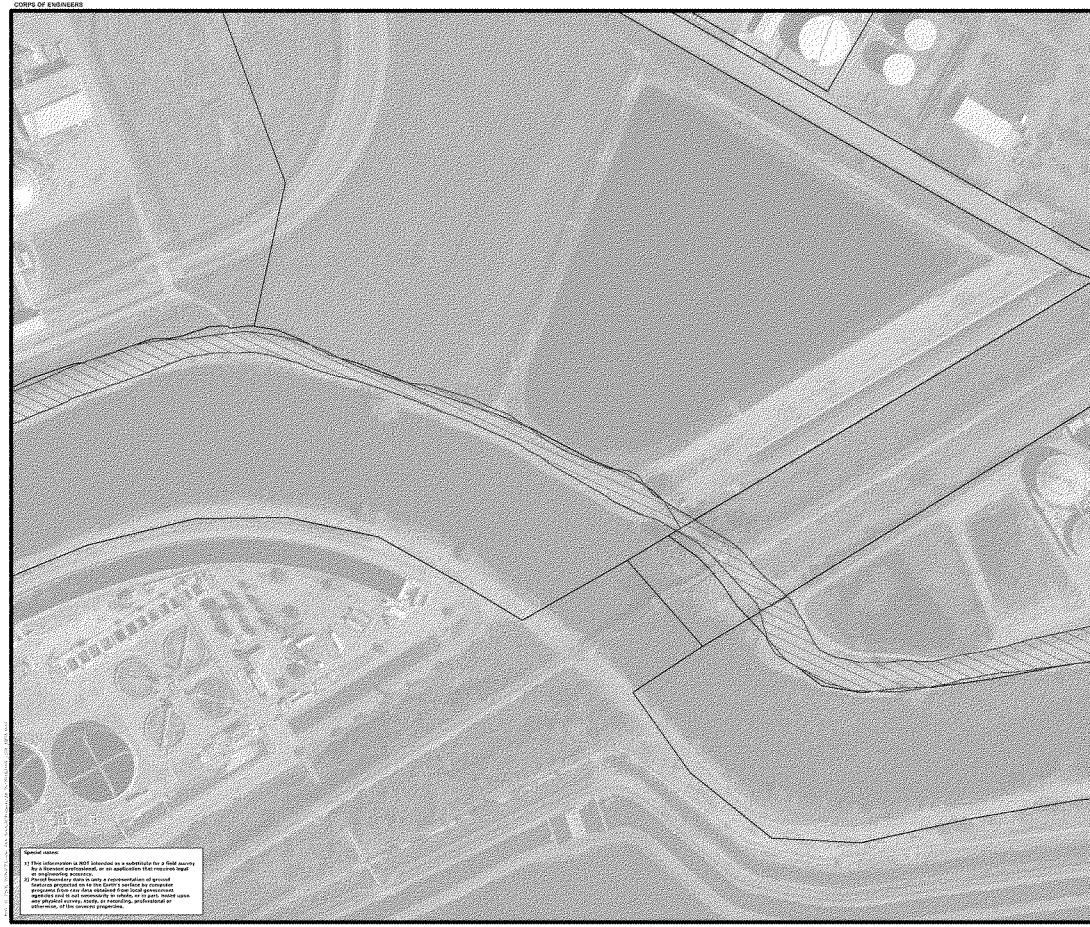
OFFICE: CHIEF OF ENGINEERS, WASHINGTON D.C. D.D.
REMIS CODE:
REMIS UNIQUE ID:
DESIGNATION OF PROJECT # SJR

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"x34")

SHEET 29 OF 38 DRAWING NO.

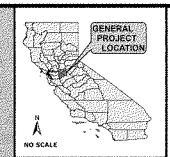
ER 405-1-250 Eng Form 1558b, Oct 81

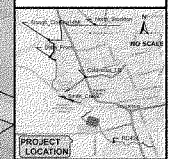
(Ver. Oct 01, 2015)

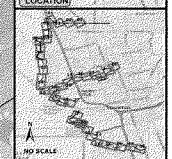


Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features based on aerial photo interpretation and mapping programs from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.







MARGINALIA

Coordinate System:
NAD 1983 2011 StatePlane California III (FIPS 0403) FtUS
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG,

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { OUTGRANT / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFER { WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { OUTGRANT / USE PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { FTS / ETS
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THIS LEGEND IS STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1959.

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
0.4 RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO REVIEW
ENGINEER
SUBMITTED BY STEVE J. CAREY, CHIEF, CARTOGRAPHIC SECTION
RECOMMENDED BY PAUL V. ZANNO (ACTING), CHIEF, R/E & RIGHT MANAGER

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

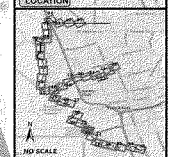
Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI B (22"x34").

SHEET 30 OF 38 DRAWING NO.

(Ver. Oct 01, 2013) ER 405-1-12C Eng. Form 4164C, Oct 81

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or boundary accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software. Parcel data is obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, preliminary or otherwise, of the covered properties.



DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (EXTINGUISHMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (AUTHORIZATION / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / TERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (EXTINGUISHMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (TO / FROM)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

MARGINALIA

N

1 inch = 100 feet

0 30 60 120 180 240
Feet
Scale Factor 1.0000
NAD 1983 2011 StatePlane California III (FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20181104.DWG,

LEGEND

(EXCEPT FOR AERIAL IMAGERY, SYMBOLS BELOW MAY OPTIONALLY BE CONFORMED TO U.S. ARMY FIELD MANUAL, FM 1-1-30, TOPOGRAPHIC SYMBOLS, DEC. 1968.)

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CHECKED BY:
SAN JOAQUIN CALIFORNIA

SUBMITTED BY: STEVE J. CAREY, CHIEF, CONTRACTING DIVISION

RECOMMENDED BY: PAUL V. DANKO (ACTING), CHIEF, REAL ESTATE DIVISION

APPROVED BY: DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION, DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE: CHIEF OF ENGINEERS, WASHINGTON DI, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI D (22"X34").

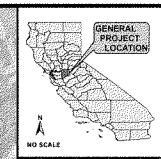
SHEET 31 OF 38 DRAWING NO.

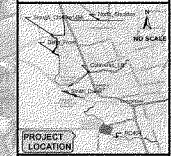
ER 405-1-12B Eng_Form (ASBL 06181)

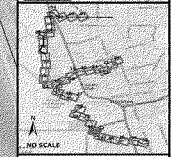
(Ver. Oct 01, 2013)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering services.
2) Parcel boundary data is only a representation of ground features and may not reflect legal land ownership. Information progresses from raw data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.







DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN { WITHDRAWN / USE PERMIT
USC PERMIT (Other than P.D.)
TRANSFER { WITHDRAWN / USE PERMIT
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS { EASEMENT / PERMIT / LICENSE

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN { CAT.I/Grantees / USC PERMIT
USE PERMIT (Other than P.D.)
TRANSFERRED { Fed. / Non-Fed.
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

(EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW MAP SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1962.)

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

0 50 100 200 Feet
0 25 50 100 Meters

Coordinate System:
NAD 1983 2011 StatePlane California III (FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20190108 using ED's design; Alt 7a-LeveeFootprints_20161222.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG,

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH
DRAFTER BY
SUBMITTED BY
STEVE J. CAREY
CHIEF CADASTRAL SECTION
RECOMMENDED BY
PAUL V. ZIANNO (ACTING)
CHIEF, R/E & PROJ. MGMNT.

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

OFFICE, CHIEF OF ENGINEERS, WASHINGTON D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally finalized by ANE D. ZITZIC

SHEET 32 OF 38
DRAWING NO.

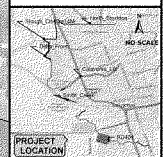
(Ver. Oct 01, 2013)
ER 405-1-206 Eng. Form 1496b, Oct 81

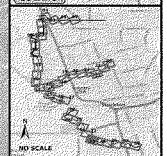
CORPS OF ENGINEERS

U.S. ARMY

General notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representative of ground features proposed on this Earth's surface by computer aided drafting (CAD) data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, state, or recording, professional or otherwise, of the covered properties.





MARGINALIA

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingE's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (DEPARTMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (DEPARTMENT / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (DEPARTMENT / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (DEPARTMENT / USE PERMIT)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS ASSIGNED TO LINE MAP DATA, SYMBOLS ARE STANDARD IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1965.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LB
- RE-FPLE-MITIGATION
- RE-FPLE-WSI
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJK
CARTO TECH
CHECKED BY
SAN JOAQUIN
CALIFORNIA

SUBMITTED BY
STEVE J CAREY
CHIEF, CARTOGRAPHIC SECTION

RECOMMENDED BY
PAUL V. DANKO (ACTING)
CHIEF, GIS & SURVEY DIVISION

APPROVED BY DIANE SIMPSON
CHIEF, REAL ESTATE DIVISION
DATE

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE: CHIEF OF ENGINEERS, WASHINGTON DC D.O.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # SJR

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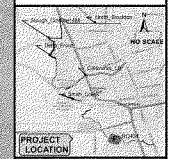
SHEET 33 OF 38
DRAWING NO.

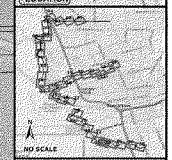
ER 405-1-200
Eng. Form 1458, Oct 81

(Rev. Oct 01, 2015)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features and locations. Parcel data is a compilation of proposed fract.ion data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or mapping, professional or otherwise, of the covered properties.





DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FED / NON-FED)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARD IN U.S. ARMY TOPO MANUAL, FM 21-26, TOPOGRAPHIC SYMBOLS, DEC. 1966

Federal
Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

FEET
0 50 25 50 100 150 200

Coordinate System:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using EFx design; Alt 7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG,

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
DATA TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, RDS & RIGHT WAYS
APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # FC

Date Saved: 11/13/2017 2:54:26 PM
This sheet originally finalized to ANE D 27"x34"

SHEET 34 OF 38 DRAWING NO.

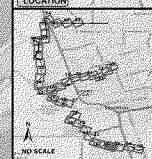
(Ver. Oct 01, 2015) ER 405-1-200 Eng_Form 5436A, Oct 81

CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features processed on to this Earth's surface by computer mapping software. Use obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.



MARGINALIA

1 inch = 100 feet

Scale

0 50 25 125 100 200

Date Date
NAD 1983 2011 StatePlane California III (FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design: Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing: "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 8TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (To)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW, MAP SYMBOLS ARE STANDARD FOR U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1966

Federal
Non-Fed
Takes_All_LSJR
RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
CARTO TECH:
CHECKED BY:
SAN JOAQUIN CALIFORNIA

SUBMITTED BY
STEVE J CAREY
CHIEF, CADASTRAL SECTION

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY
PAUL V. DANNO (ACTING)
CHIEF, REAL ESTATE DIVISION

APPROVED BY DIANE SIMPSON DATE
CHIEF, REAL ESTATE DIVISION

OFFICE: CHIEF OF ENGINEERS, WASHINGTON DC D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT FC

Date Saved: 11/13/2017 2:54:20 PM
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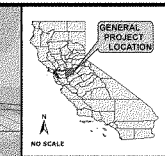
SHEET 35 OF 38 DRAWING NO

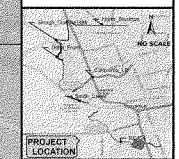
ER 405-1-700 Eng_Form 1495A, Oct 81

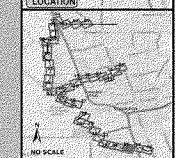
(Ver. Oct 01, 2015)

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features and is not a legal survey. Data is compiled from programs from one state-wide and two local government agencies and is not necessarily in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.







MARGINALIA

1 inch = 100 feet

Coordinate System:
NAD 1983 2011 StatePlane California III (FIPS 0403) FT US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160106 using ED's design; Alt7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSER INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FDS /)
LEASES TERMINATED
LESSER INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN BELOW THE SYMBOLS ARE STANDARD IN U. S. ARMY TOPO MANUAL, FM 21-31 TOPOGRAPHIC SYMBOLS, DEC. 1964.

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-WS
RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER SJC
DATE TECH.
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, CADASTRAL SECTION
RECOMMENDED BY PAUL V. ZIANNO (ACTING), CHIEF, RPD & REAL ESTATE DIVISION
APPROVED BY DIANE SIMPSON, CHIEF, REAL ESTATE DIVISION
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

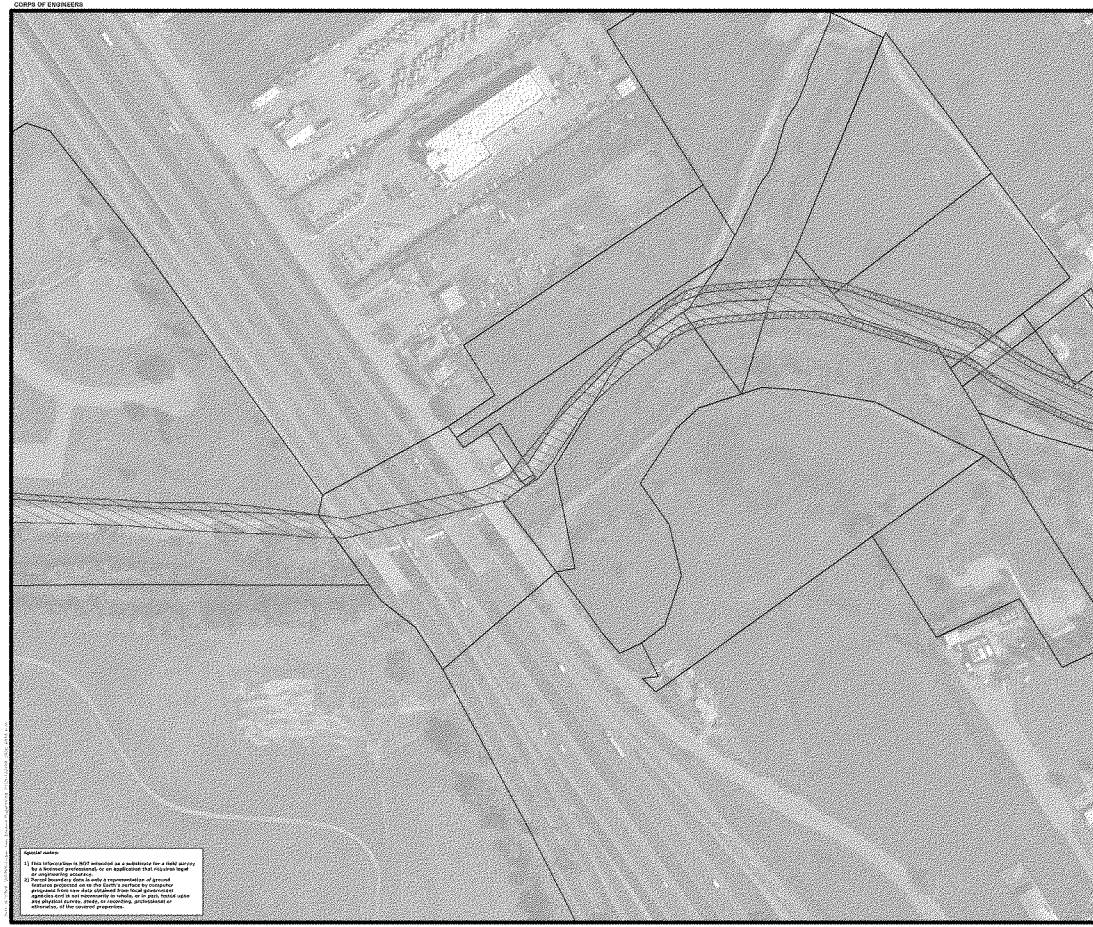
OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMS CODE:
REMS UNIQUE ID:
INSTALLATION OR PROJECT # FC

Date Saved: 11/13/2017 2:54:20 PM
This sheet originally formatted to ANSI B, 17"X11".

SHEET 36 OF 38 DRAWING NO.

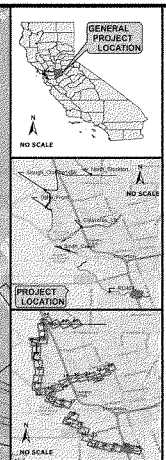
(Ver. Oct 01, 2015)

ER 405-1-12B Eng_Form 1496A, Oct 81



Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground features projected on to this Earth's surface by computer software. Parcel boundary data obtained from local government agencies and is not necessarily in whole, or in part, based upon any physical survey, deed, or recording, professional or otherwise, of the covered properties.



MARGINALIA

N

1 inch = 100 feet

Feet
0 50 100 200 300 400

Data Date:
NAD 1983 2011 StatePlane California III FIPS 0403 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt.7a-LeveeFootprints_20151223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20151104.DWG.

DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 6TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / USE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / USE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT ICE MASS, WATER BODIES (BLUE), AND CERTAIN BOUNDARY IN U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

- Federal
- Non-Fed

Takes_All_LSJR

- RE-FPLE-CANAL
- RE-FPLE-CLOSURE-STRUCTURE
- RE-FPLE-FLOODWALL
- RE-FPLE-LS
- RE-FPLE-MITIGATION
- RE-FPLE-WS
- RE-LEVEE-FPLE

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER DJC
CARTO TECH
CHECKED BY
SAN JOAQUIN CALIFORNIA

SUBMITTED BY: STEVE J. CAREY, CHIEF, CONTINENTAL DIVISION

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

RECOMMENDED BY: PAUL V. DANKO (ACTING), CHIEF, REAL ESTATE DIVISION
APPROVED BY: DANE SIMPSON, CHIEF, REAL ESTATE DIVISION, DATE

OFFICE: CHIEF OF ENGINEERS, WASHINGTON, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # DC

Date Saved: 11/13/2017 2:54:20 PM
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SHEET 37 OF 38 DRAWING NO.

ER 405-1-200 Eng Form 1426B, Oct 81

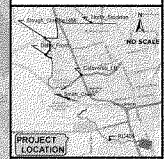
(Ver. Oct 01, 2015)

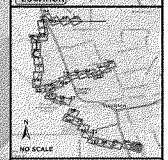
CORPS OF ENGINEERS

U.S. ARMY

Special notes:

1) This information is NOT intended as a substitute for a field survey by a licensed professional, or an application that requires legal or engineering accuracy.
2) Parcel boundary data is only a representation of ground conditions as of the date of the survey. Data is compiled primarily from tax data obtained from local government agencies and is not consistently in whole, or in part, based upon any physical survey, study, or recording, professional or otherwise, of the covered properties.





DRAFT <30% Design
As Applicable

PROJECT MAP

DEPARTMENT OF THE ARMY
USING SERVICE U.S. ARMY

LOCATION OF PROJECT

STATE CALIFORNIA
COUNTY SAN JOAQUIN
DIVISION SOUTH PACIFIC DIVISION (SPD)
DISTRICT SACRAMENTO (SPK)
ARMY AREA 5TH ARMY
30 Miles S.W. OF COALINGA
OF

TRANSPORTATION FACILITIES

STATE ROADS US HWY X
FEDERAL ROADS STATE HWY XXX
AIRPORTS XXXXX AIRPORT (XXX)

ACQUISITION

TOTAL ACRES ACQUIRED NO AREA
FEE
PUBLIC DOMAIN (WITHDRAWN / LEE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFER (WITHDRAWN / LEE PERMIT)
LEASE
EASEMENT RESERVED IN FEE DISPOSAL
LESSEE INTERESTS (EASEMENT / PERMIT / LICENSE)

DISPOSAL

TOTAL ACRES DISPOSED NO AREA
SOLD
PUBLIC DOMAIN (WITHDRAWN / LEE PERMIT)
USE PERMIT (Other than P.D.)
TRANSFERRED (FEE / LEASE)
LEASES TERMINATED
LESSEE INTERESTS TERM
REASSIGNED
ACRES TO

LEGEND

EXCEPT FOR SPECIAL SYMBOLS SHOWN SOLID, TEXT STYLES AND LANDMARKS AS U.S. ARMY FIELD MANUAL, FM 21-31, TOPOGRAPHIC SYMBOLS, DEC. 1969.

Federal
Non-Fed

Takes_All_LSJR

RE-FPLE-CANAL
RE-FPLE-CLOSURE-STRUCTURE
RE-FPLE-FLOODWALL
RE-FPLE-LS
RE-FPLE-MITIGATION
RE-FPLE-NS
RE-LEVEE-FPLE

MARGINALIA

N

1 inch = 100 feet

0 35 65 130 195 260 Feet

Coordinate System:
NAD 1983 2011 StatePlane California III (US Survey) FIPS 0403 Feet
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Feet US

ACQUISITION AUTHORIZATION

Update on 20160108 using ED's design; Alt 7a-LeveeFootprints_20161223.DWG.

Real Property Estates were created usingED's Drawing; "Alternative7a-Levee Footprints_20161104.DWG,

REAL ESTATE OWNERSHIP/ESTATE MAP

DEPARTMENT OF THE ARMY
OFFICE OF THE SACRAMENTO DISTRICT ENGINEER
SOUTH PACIFIC DIVISION

CARTOGRAPHER GIC
CARTO TECH
CHECKED BY
SUBMITTED BY STEVE J. CAREY, CHIEF, TECHNICAL SECTION
RECOMMENDED BY PAUL W. ZIANNO (ACTING), CHIEF, RED & RIGHT BRANCH
APPROVED BY DIANE SIMPSON, CHIEF, RED, LOWER DIVISION
DATE

SAN JOAQUIN CALIFORNIA

REAL ESTATE DIVISION
LOWER SAN JOAQUIN RIVER
Alternative 7A

OFFICE, CHIEF OF ENGINEERS, WASHINGTON 25, D.C.
REMIS CODE:
REMIS UNIQUE ID:
INSTALLATION OR PROJECT # DC

Date Saved: 11/13/2017 2:54:20 PM
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SHEET # 38 OF 38
DRAWING NO.

(Rev. Oct 01, 2012)

ER 405-2-250 Eng. Form 1426A, Oct 81

LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY TRACT REGISTER

Contract	Estate_Layer	Take_Area_GIS
Delta_Front	RE-LEVEE-FPLE	2.779
Delta_Front	RE-FPLE-CLOSURE-STRUCTURE	0.023
North_Stockton	RE-FPLE-LS	1.386
North_Stockton	RE-LEVEE-FPLE	6.579
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-LEVEE-FPLE	0.076
Delta_Front	RE-FPLE-LS	0.479
North_Stockton	RE-FPLE-WS	0.035
North_Stockton	RE-FPLE-WS	1.388
North_Stockton	RE-LEVEE-FPLE	0.829
North_Stockton	RE-LEVEE-FPLE	0.045
North_Stockton	RE-FPLE-LS	0.014
North_Stockton	RE-FPLE-WS	0.018
Delta_Front	RE-FPLE-MITIGATION	8.551
Delta_Front	RE-LEVEE-FPLE	10.870
Delta_Front	RE-FPLE-LS	1.440
Delta_Front	RE-FPLE-CANAL	1.431
Delta_Front	RE-FPLE-LS	0.469
Delta_Front	RE-FPLE-CLOSURE-STRUCTURE	0.030
Delta_Front	RE-FPLE-MITIGATION	0.851
Delta_Front	RE-LEVEE-FPLE	3.963
Delta_Front	RE-LEVEE-FPLE	1.958
Delta_Front	RE-FPLE-LS	0.261
Delta_Front	RE-FPLE-LS	0.492
Delta_Front	RE-LEVEE-FPLE	0.757
Delta_Front	RE-FPLE-MITIGATION	4.227
Delta_Front	RE-LEVEE-FPLE	0.307
Delta_Front	RE-LEVEE-FPLE	5.190
Delta_Front	RE-FPLE-LS	0.693
Delta_Front	RE-FPLE-CANAL	0.687
Delta_Front	RE-LEVEE-FPLE	0.035
Delta_Front	RE-LEVEE-FPLE	5.082
Delta_Front	RE-FPLE-WS	0.542
Delta_Front	RE-FPLE-LS	0.548
Delta_Front	RE-LEVEE-FPLE	3.809
Delta_Front	RE-LEVEE-FPLE	0.458
North_Stockton	RE-FPLE-LS	0.782
North_Stockton	RE-LEVEE-FPLE	0.694
Delta_Front	RE-FPLE-LS	0.066
North_Stockton	RE-FPLE-WS	0.030
North_Stockton	RE-LEVEE-FPLE	0.102
North_Stockton	RE-FPLE-LS	0.781
North_Stockton	RE-FPLE-LS	0.083
North_Stockton	RE-LEVEE-FPLE	4.138
North_Stockton	RE-FPLE-LS	0.006

North_Stockton	RE-FPLE-LS	0.008
North_Stockton	RE-FPLE-LS	0.010
North_Stockton	RE-FPLE-LS	0.009
North_Stockton	RE-FPLE-LS	0.010
North_Stockton	RE-FPLE-LS	0.010
North_Stockton	RE-FPLE-LS	0.015
North_Stockton	RE-FPLE-LS	0.019
North_Stockton	RE-LEVEE-FPLE	0.101
North_Stockton	RE-FPLE-LS	0.053
North_Stockton	RE-FPLE-WS	0.049
North_Stockton	RE-FPLE-LS	0.114
North_Stockton	RE-LEVEE-FPLE	0.036
North_Stockton	RE-FPLE-LS	0.013
North_Stockton	RE-LEVEE-FPLE	0.014
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.016
North_Stockton	RE-FPLE-LS	0.027
North_Stockton	RE-LEVEE-FPLE	0.016
North_Stockton	RE-FPLE-LS	0.027
North_Stockton	RE-LEVEE-FPLE	0.017
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.017
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.019
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.022
North_Stockton	RE-FPLE-LS	0.026
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North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.017
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North_Stockton	RE-LEVEE-FPLE	0.012
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North_Stockton	RE-LEVEE-FPLE	0.011
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.009
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-WS	0.355

North_Stockton	RE-LEVEE-FPLE	0.785
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North_Stockton	RE-LEVEE-FPLE	0.298
North_Stockton	RE-FPLE-LS	0.044
North_Stockton	RE-LEVEE-FPLE	0.020
North_Stockton	RE-FPLE-LS	0.036
North_Stockton	RE-LEVEE-FPLE	0.015
North_Stockton	RE-FPLE-LS	0.048
North_Stockton	RE-LEVEE-FPLE	0.018
North_Stockton	RE-FPLE-LS	0.020
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-WS	0.280
North_Stockton	RE-LEVEE-FPLE	0.538
North_Stockton	RE-FPLE-LS	0.025
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North_Stockton	RE-LEVEE-FPLE	0.021
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.017
North_Stockton	RE-FPLE-LS	0.026
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North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.018
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.018
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.019
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.019
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.022
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.023
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.026
North_Stockton	RE-FPLE-LS	0.042
North_Stockton	RE-LEVEE-FPLE	0.040
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North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-FPLE-LS	0.026
North_Stockton	RE-LEVEE-FPLE	0.005

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North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.008
North_Stockton	RE-FPLE-WS	0.087
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North_Stockton	RE-FPLE-LS	0.005
North_Stockton	RE-LEVEE-FPLE	0.946
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North_Stockton	RE-FPLE-LS	0.034
North_Stockton	RE-FPLE-WS	0.230
North_Stockton	RE-FPLE-WS	0.132
North_Stockton	RE-FPLE-WS	0.050
North_Stockton	RE-FPLE-LS	0.021
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-LS	0.020
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.009
North_Stockton	RE-FPLE-LS	0.021
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North_Stockton	RE-FPLE-LS	0.031
North_Stockton	RE-LEVEE-FPLE	0.028
North_Stockton	RE-FPLE-LS	0.050
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North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.013
North_Stockton	RE-FPLE-LS	0.027
North_Stockton	RE-LEVEE-FPLE	0.009
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-FPLE-LS	0.021
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.008
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.007

North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.008
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North_Stockton	RE-LEVEE-FPLE	0.012
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.011
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.011
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.008
North_Stockton	RE-FPLE-LS	0.017
North_Stockton	RE-LEVEE-FPLE	0.012
North_Stockton	RE-FPLE-LS	0.022
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North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.012
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.008
North_Stockton	RE-FPLE-LS	0.022
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North_Stockton	RE-LEVEE-FPLE	0.012
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North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.011
North_Stockton	RE-FPLE-LS	0.036
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.035
North_Stockton	RE-LEVEE-FPLE	0.031
North_Stockton	RE-FPLE-LS	0.037
North_Stockton	RE-LEVEE-FPLE	0.015
North_Stockton	RE-FPLE-LS	0.035
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.025

North_Stockton	RE-FPLE-LS	0.043
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.018
North_Stockton	RE-FPLE-LS	0.039
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-LS	0.018
North_Stockton	RE-LEVEE-FPLE	0.027
North_Stockton	RE-FPLE-LS	0.044
North_Stockton	RE-LEVEE-FPLE	0.044
North_Stockton	RE-FPLE-LS	0.039
North_Stockton	RE-LEVEE-FPLE	0.028
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.023
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.018
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.024
North_Stockton	RE-FPLE-LS	0.033
North_Stockton	RE-LEVEE-FPLE	0.008
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.023
North_Stockton	RE-FPLE-LS	0.042
North_Stockton	RE-LEVEE-FPLE	0.019
North_Stockton	RE-FPLE-LS	0.029
North_Stockton	RE-LEVEE-FPLE	0.015
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.013
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.015
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.015
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.022
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-LEVEE-FPLE	0.010
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.009
North_Stockton	RE-FPLE-LS	0.032
North_Stockton	RE-LEVEE-FPLE	0.007
North_Stockton	RE-FPLE-LS	0.034
North_Stockton	RE-FPLE-LS	0.017
North_Stockton	RE-FPLE-LS	0.017

North_Stockton	RE-FPLE-LS	0.016
North_Stockton	RE-FPLE-LS	0.019
North_Stockton	RE-FPLE-LS	0.020
North_Stockton	RE-FPLE-LS	0.023
North_Stockton	RE-FPLE-LS	0.025
North_Stockton	RE-LEVEE-FPLE	0.006
North_Stockton	RE-FPLE-LS	0.045
Calaveras_RB	RE-LEVEE-FPLE	0.264
Calaveras_RB	RE-LEVEE-FPLE	0.008
Calaveras_RB	RE-LEVEE-FPLE	0.073
Calaveras_LB	RE-LEVEE-FPLE	3.189
Calaveras_LB	RE-FPLE-WS	0.871
Calaveras_LB	RE-FPLE-LS	0.862
Calaveras_LB	RE-LEVEE-FPLE	1.599
Calaveras_LB	RE-FPLE-WS	0.468
Calaveras_LB	RE-FPLE-LS	0.548
Calaveras_LB	RE-FPLE-CLOSURE-STRUCTURE	0.108
Calaveras_LB	RE-LEVEE-FPLE	0.174
Calaveras_LB	RE-FPLE-WS	0.082
Calaveras_LB	RE-FPLE-LS	0.068
Calaveras_LB	RE-LEVEE-FPLE	0.058
Calaveras_LB	RE-FPLE-WS	0.026
Calaveras_LB	RE-FPLE-LS	0.024
Calaveras_LB	RE-LEVEE-FPLE	0.085
Calaveras_LB	RE-LEVEE-FPLE	0.012
Calaveras_LB	RE-LEVEE-FPLE	0.495
Calaveras_LB	RE-LEVEE-FPLE	0.013
Calaveras_LB	RE-LEVEE-FPLE	1.119
Calaveras_LB	RE-LEVEE-FPLE	0.083
Calaveras_LB	RE-LEVEE-FPLE	0.113
Calaveras_LB	RE-LEVEE-FPLE	0.114
Calaveras_LB	RE-LEVEE-FPLE	0.111
Calaveras_LB	RE-LEVEE-FPLE	0.093
Calaveras_LB	RE-LEVEE-FPLE	0.128
Calaveras_LB	RE-LEVEE-FPLE	0.103
Calaveras_LB	RE-LEVEE-FPLE	0.098
Calaveras_LB	RE-LEVEE-FPLE	0.099
Calaveras_LB	RE-LEVEE-FPLE	0.099
Calaveras_LB	RE-LEVEE-FPLE	0.102
Calaveras_LB	RE-LEVEE-FPLE	0.103
Calaveras_LB	RE-LEVEE-FPLE	0.101
Calaveras_LB	RE-LEVEE-FPLE	0.099
Calaveras_LB	RE-LEVEE-FPLE	0.108
Calaveras_LB	RE-LEVEE-FPLE	0.107
Calaveras_LB	RE-LEVEE-FPLE	0.112
Calaveras_LB	RE-LEVEE-FPLE	0.102
Calaveras_LB	RE-LEVEE-FPLE	0.106

Calaveras_LB	RE-LEVEE-FPLE	0.081
Calaveras_LB	RE-LEVEE-FPLE	0.622
Calaveras_LB	RE-LEVEE-FPLE	0.301
Calaveras_LB	RE-LEVEE-FPLE	0.268
Calaveras_LB	RE-LEVEE-FPLE	0.089
Calaveras_LB	RE-LEVEE-FPLE	0.109
Calaveras_LB	RE-LEVEE-FPLE	0.010
Calaveras_LB	RE-LEVEE-FPLE	0.058
Calaveras_LB	RE-LEVEE-FPLE	0.098
Calaveras_LB	RE-LEVEE-FPLE	0.007
Calaveras_LB	RE-LEVEE-FPLE	0.009
Calaveras_LB	RE-LEVEE-FPLE	0.008
Calaveras_LB	RE-LEVEE-FPLE	0.011
Calaveras_LB	RE-LEVEE-FPLE	0.027
Calaveras_LB	RE-LEVEE-FPLE	0.008
Calaveras_LB	RE-LEVEE-FPLE	1.266
Calaveras_RB	RE-LEVEE-FPLE	1.469
Calaveras_RB	RE-LEVEE-FPLE	1.497
Calaveras_RB	RE-LEVEE-FPLE	2.631
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.042
Calaveras_RB	RE-LEVEE-FPLE	0.018
Calaveras_LB	RE-LEVEE-FPLE	0.059
Calaveras_LB	RE-LEVEE-FPLE	0.452
Calaveras_LB	RE-LEVEE-FPLE	0.075
Calaveras_LB	RE-LEVEE-FPLE	0.061
Calaveras_LB	RE-LEVEE-FPLE	0.199
Calaveras_LB	RE-LEVEE-FPLE	0.114
Calaveras_LB	RE-LEVEE-FPLE	0.102
Calaveras_LB	RE-LEVEE-FPLE	0.133
Calaveras_LB	RE-LEVEE-FPLE	0.150
Calaveras_LB	RE-LEVEE-FPLE	0.029
Calaveras_LB	RE-LEVEE-FPLE	0.076
Calaveras_LB	RE-LEVEE-FPLE	0.025
Calaveras_LB	RE-LEVEE-FPLE	0.211
Calaveras_LB	RE-LEVEE-FPLE	0.014
Calaveras_LB	RE-LEVEE-FPLE	0.035
Calaveras_LB	RE-LEVEE-FPLE	0.063
Calaveras_LB	RE-LEVEE-FPLE	0.053
Calaveras_LB	RE-LEVEE-FPLE	0.064
Calaveras_LB	RE-LEVEE-FPLE	0.036
Calaveras_LB	RE-LEVEE-FPLE	0.037
Calaveras_LB	RE-LEVEE-FPLE	0.039
Calaveras_LB	RE-LEVEE-FPLE	0.143
Calaveras_LB	RE-LEVEE-FPLE	0.110
Calaveras_LB	RE-LEVEE-FPLE	0.126
Calaveras_LB	RE-LEVEE-FPLE	0.057

Calaveras_LB	RE-LEVEE-FPLE	0.045
Calaveras_LB	RE-LEVEE-FPLE	0.098
Calaveras_LB	RE-LEVEE-FPLE	0.035
Calaveras_LB	RE-LEVEE-FPLE	0.170
Calaveras_LB	RE-LEVEE-FPLE	0.178
Calaveras_LB	RE-LEVEE-FPLE	0.188
Calaveras_LB	RE-LEVEE-FPLE	0.204
Calaveras_LB	RE-LEVEE-FPLE	0.066
Calaveras_LB	RE-LEVEE-FPLE	0.063
Calaveras_LB	RE-LEVEE-FPLE	0.107
Calaveras_LB	RE-LEVEE-FPLE	0.078
Calaveras_LB	RE-LEVEE-FPLE	0.051
Calaveras_LB	RE-LEVEE-FPLE	0.144
Calaveras_LB	RE-LEVEE-FPLE	0.067
Calaveras_LB	RE-LEVEE-FPLE	0.013
Calaveras_LB	RE-LEVEE-FPLE	0.086
Calaveras_LB	RE-LEVEE-FPLE	0.085
Calaveras_LB	RE-LEVEE-FPLE	0.472
Calaveras_LB	RE-LEVEE-FPLE	0.167
Calaveras_LB	RE-LEVEE-FPLE	0.008
Calaveras_LB	RE-LEVEE-FPLE	0.222
Calaveras_LB	RE-LEVEE-FPLE	0.084
Calaveras_LB	RE-LEVEE-FPLE	0.062
Calaveras_LB	RE-LEVEE-FPLE	0.010
Calaveras_LB	RE-LEVEE-FPLE	0.015
Calaveras_LB	RE-LEVEE-FPLE	0.009
Calaveras_LB	RE-LEVEE-FPLE	0.013
Calaveras_LB	RE-LEVEE-FPLE	0.012
Calaveras_LB	RE-LEVEE-FPLE	0.643
Calaveras_LB	RE-LEVEE-FPLE	0.154
Calaveras_LB	RE-LEVEE-FPLE	1.696
Calaveras_LB	RE-LEVEE-FPLE	1.895
Calaveras_LB	RE-LEVEE-FPLE	0.499
Calaveras_LB	RE-LEVEE-FPLE	1.680
Calaveras_LB	RE-LEVEE-FPLE	0.005
Calaveras_LB	RE-LEVEE-FPLE	0.006
Calaveras_LB	RE-LEVEE-FPLE	0.009
Delta_Front	RE-FPLE-MITIGATION	0.079
Delta_Front	RE-LEVEE-FPLE	7.877
Delta_Front	RE-LEVEE-FPLE	0.145
Delta_Front	RE-FPLE-MITIGATION	0.045
Delta_Front	RE-LEVEE-FPLE	0.104
Delta_Front	RE-LEVEE-FPLE	1.188
Delta_Front	RE-LEVEE-FPLE	0.751
Delta_Front	RE-LEVEE-FPLE	6.189
Delta_Front	RE-LEVEE-FPLE	0.008
Delta_Front	RE-LEVEE-FPLE	0.016

Delta_Front	RE-LEVEE-FPLE	0.017
Delta_Front	RE-LEVEE-FPLE	0.015
Delta_Front	RE-LEVEE-FPLE	0.014
Delta_Front	RE-LEVEE-FPLE	0.851
Delta_Front	RE-LEVEE-FPLE	0.013
Delta_Front	RE-LEVEE-FPLE	2.349
Delta_Front	RE-LEVEE-FPLE	0.061
Delta_Front	RE-LEVEE-FPLE	0.028
Calaveras_RB	RE-LEVEE-FPLE	2.032
Calaveras_RB	RE-LEVEE-FPLE	1.174
Calaveras_RB	RE-LEVEE-FPLE	3.946
Calaveras_RB	RE-LEVEE-FPLE	1.454
Calaveras_RB	RE-LEVEE-FPLE	2.059
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.017
Calaveras_RB	RE-LEVEE-FPLE	0.013
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.013
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.005
Calaveras_RB	RE-LEVEE-FPLE	0.006
Calaveras_RB	RE-LEVEE-FPLE	0.008
Calaveras_RB	RE-LEVEE-FPLE	0.006
Calaveras_RB	RE-LEVEE-FPLE	0.008
Calaveras_RB	RE-LEVEE-FPLE	0.011
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.008
Calaveras_RB	RE-LEVEE-FPLE	0.009
Calaveras_RB	RE-LEVEE-FPLE	0.043
Calaveras_RB	RE-LEVEE-FPLE	0.039
Calaveras_RB	RE-LEVEE-FPLE	0.038
Calaveras_RB	RE-LEVEE-FPLE	0.037
Calaveras_RB	RE-LEVEE-FPLE	0.033
Calaveras_RB	RE-LEVEE-FPLE	0.031
Calaveras_RB	RE-LEVEE-FPLE	0.027
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.032
Calaveras_RB	RE-LEVEE-FPLE	0.029
Calaveras_RB	RE-LEVEE-FPLE	0.014
Calaveras_RB	RE-LEVEE-FPLE	0.029
Calaveras_RB	RE-LEVEE-FPLE	0.030
Calaveras_RB	RE-LEVEE-FPLE	0.031
Calaveras_RB	RE-LEVEE-FPLE	0.029
Calaveras_RB	RE-LEVEE-FPLE	0.029

Calaveras_RB	RE-LEVEE-FPLE	0.023
Calaveras_RB	RE-LEVEE-FPLE	0.020
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.027
Calaveras_RB	RE-LEVEE-FPLE	0.029
Calaveras_RB	RE-LEVEE-FPLE	0.029
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.026
Calaveras_RB	RE-LEVEE-FPLE	0.036
Calaveras_RB	RE-LEVEE-FPLE	0.079
Calaveras_RB	RE-LEVEE-FPLE	0.043
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.011
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.011
Calaveras_RB	RE-LEVEE-FPLE	0.011
Calaveras_RB	RE-LEVEE-FPLE	0.006
Calaveras_RB	RE-LEVEE-FPLE	0.005
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.014
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.010
Calaveras_RB	RE-LEVEE-FPLE	0.013
Calaveras_RB	RE-LEVEE-FPLE	0.017
Calaveras_RB	RE-LEVEE-FPLE	0.019
Calaveras_RB	RE-LEVEE-FPLE	0.023
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.025
Calaveras_RB	RE-LEVEE-FPLE	0.023
Calaveras_RB	RE-LEVEE-FPLE	0.021
Calaveras_RB	RE-LEVEE-FPLE	0.018
Calaveras_RB	RE-LEVEE-FPLE	0.014
Calaveras_RB	RE-LEVEE-FPLE	0.006
Calaveras_RB	RE-LEVEE-FPLE	0.007
Calaveras_RB	RE-LEVEE-FPLE	0.009
Calaveras_RB	RE-LEVEE-FPLE	0.012
Calaveras_RB	RE-LEVEE-FPLE	0.013
Calaveras_RB	RE-LEVEE-FPLE	0.014
Calaveras_RB	RE-LEVEE-FPLE	0.017
Calaveras_RB	RE-LEVEE-FPLE	0.020
Calaveras_RB	RE-LEVEE-FPLE	0.020
Calaveras_RB	RE-LEVEE-FPLE	0.019
Calaveras_RB	RE-LEVEE-FPLE	0.016
Calaveras_RB	RE-LEVEE-FPLE	0.019
Calaveras_RB	RE-LEVEE-FPLE	0.018
Calaveras_RB	RE-LEVEE-FPLE	0.028

Calaveras_RB	RE-LEVEE-FPLE	0.006
Calaveras_RB	RE-LEVEE-FPLE	0.082
Calaveras_RB	RE-LEVEE-FPLE	0.079
Delta_Front	RE-LEVEE-FPLE	0.076
Delta_Front	RE-LEVEE-FPLE	0.081
Delta_Front	RE-LEVEE-FPLE	0.123
Delta_Front	RE-LEVEE-FPLE	0.084
Delta_Front	RE-LEVEE-FPLE	0.093
Delta_Front	RE-LEVEE-FPLE	0.103
Delta_Front	RE-LEVEE-FPLE	0.123
Delta_Front	RE-LEVEE-FPLE	0.073
Delta_Front	RE-LEVEE-FPLE	0.087
Delta_Front	RE-LEVEE-FPLE	0.027
Delta_Front	RE-LEVEE-FPLE	0.074
Delta_Front	RE-LEVEE-FPLE	0.105
Delta_Front	RE-LEVEE-FPLE	0.100
Delta_Front	RE-LEVEE-FPLE	0.089
Delta_Front	RE-LEVEE-FPLE	0.089
Delta_Front	RE-LEVEE-FPLE	0.086
Delta_Front	RE-LEVEE-FPLE	0.085
Delta_Front	RE-LEVEE-FPLE	0.089
Delta_Front	RE-LEVEE-FPLE	0.088
Delta_Front	RE-LEVEE-FPLE	0.085
Delta_Front	RE-LEVEE-FPLE	0.086
Delta_Front	RE-LEVEE-FPLE	0.087
Delta_Front	RE-LEVEE-FPLE	0.091
Delta_Front	RE-LEVEE-FPLE	0.089
Delta_Front	RE-LEVEE-FPLE	0.086
Delta_Front	RE-LEVEE-FPLE	0.085
Delta_Front	RE-LEVEE-FPLE	0.106
Delta_Front	RE-LEVEE-FPLE	0.112
Delta_Front	RE-LEVEE-FPLE	0.109
Delta_Front	RE-LEVEE-FPLE	0.104
Delta_Front	RE-LEVEE-FPLE	0.104
Delta_Front	RE-LEVEE-FPLE	0.101
Delta_Front	RE-LEVEE-FPLE	0.097
Delta_Front	RE-LEVEE-FPLE	0.126
Delta_Front	RE-LEVEE-FPLE	0.090
Delta_Front	RE-LEVEE-FPLE	0.090
Delta_Front	RE-LEVEE-FPLE	0.088
Delta_Front	RE-LEVEE-FPLE	0.189
Smith_Canal	RE-FPLE-FLOODWALL	1.394
Smith_Canal	RE-FPLE-CLOSURE-STRUCTURE	0.338
RD_404	RE-LEVEE-FPLE	0.074
RD_404	RE-FPLE-LS	0.043
RD_404	RE-FPLE-WS	0.372
RD_404	RE-LEVEE-FPLE	2.000

RD_404	RE-LEVEE-FPLE	2.216
RD_404	RE-FPLE-LS	0.881
RD_404	RE-LEVEE-FPLE	0.262
RD_404	RE-FPLE-LS	0.151
RD_404	RE-LEVEE-FPLE	0.088
RD_404	RE-FPLE-LS	0.032
RD_404	RE-LEVEE-FPLE	0.063
RD_404	RE-FPLE-LS	0.028
RD_404	RE-LEVEE-FPLE	0.123
RD_404	RE-LEVEE-FPLE	0.751
RD_404	RE-LEVEE-FPLE	0.026
RD_404	RE-LEVEE-FPLE	1.571
RD_404	RE-LEVEE-FPLE	1.431
RD_404	RE-LEVEE-FPLE	0.332
RD_404	RE-LEVEE-FPLE	2.827
RD_404	RE-LEVEE-FPLE	2.628
RD_404	RE-LEVEE-FPLE	0.199
RD_404	RE-LEVEE-FPLE	8.236
RD_404	RE-LEVEE-FPLE	0.254
RD_404	RE-LEVEE-FPLE	0.030
RD_404	RE-LEVEE-FPLE	0.113
RD_404	RE-LEVEE-FPLE	0.075
RD_404	RE-FPLE-LS	0.049
RD_404	RE-LEVEE-FPLE	0.004
RD_404	RE-FPLE-LS	0.015
RD_404	RE-LEVEE-FPLE	0.420
RD_404	RE-FPLE-WS	0.020
RD_404	RE-FPLE-LS	0.125
RD_404	RE-LEVEE-FPLE	0.500
RD_404	RE-FPLE-WS	0.123
RD_404	RE-FPLE-LS	0.125
RD_404	RE-LEVEE-FPLE	0.365
RD_404	RE-FPLE-WS	0.103
RD_404	RE-FPLE-LS	0.080
RD_404	RE-LEVEE-FPLE	0.185
RD_404	RE-FPLE-WS	0.037
RD_404	RE-FPLE-LS	0.056
RD_404	RE-LEVEE-FPLE	0.112
RD_404	RE-LEVEE-FPLE	0.067
RD_404	RE-FPLE-WS	0.030
RD_404	RE-LEVEE-FPLE	0.119
RD_404	RE-FPLE-LS	0.062
RD_404	RE-LEVEE-FPLE	0.110
RD_404	RE-FPLE-WS	0.027
RD_404	RE-FPLE-LS	0.028
RD_404	RE-LEVEE-FPLE	0.115
RD_404	RE-FPLE-WS	0.029

RD_404	RE-FPLE-LS	0.030
RD_404	RE-LEVEE-FPLE	0.159
RD_404	RE-FPLE-WS	0.065
RD_404	RE-FPLE-LS	0.014
RD_404	RE-LEVEE-FPLE	0.666
RD_404	RE-FPLE-WS	0.164
RD_404	RE-FPLE-LS	0.168
RD_404	RE-FPLE-LS	0.004
RD_404	RE-LEVEE-FPLE	0.201
RD_404	RE-FPLE-LS	0.003
RD_404	RE-FPLE-LS	0.095
RD_404	RE-LEVEE-FPLE	0.074
RD_404	RE-LEVEE-FPLE	0.007
RD_404	RE-LEVEE-FPLE	0.001
RD_404	RE-FPLE-LS	0.001
RD_404	RE-FPLE-LS	0.016
RD_404	RE-LEVEE-FPLE	0.079
RD_404	RE-FPLE-LS	0.091
RD_404	RE-FPLE-LS	0.082
North_Stockton	RE-FPLE-LS	0.020
North_Stockton	RE-LEVEE-FPLE	0.013
Calaveras_RB	RE-LEVEE-FPLE	1.038
Calaveras_RB	RE-LEVEE-FPLE	0.052
Calaveras_RB	RE-LEVEE-FPLE	0.968
Delta_Front	RE-LEVEE-FPLE	0.447
Delta_Front	RE-LEVEE-FPLE	0.037
Calaveras_LB	RE-LEVEE-FPLE	0.005
Calaveras_LB	RE-LEVEE-FPLE	0.090
Calaveras_RB	RE-LEVEE-FPLE	2.857
Calaveras_LB	RE-FPLE-WS	0.075
Calaveras_RB	RE-LEVEE-FPLE	0.031
Calaveras_RB	RE-LEVEE-FPLE	0.240
Calaveras_LB	RE-LEVEE-FPLE	0.135
Calaveras_RB	RE-LEVEE-FPLE	1.830
Calaveras_LB	RE-LEVEE-FPLE	1.049
Calaveras_RB	RE-LEVEE-FPLE	1.607
Calaveras_RB	RE-LEVEE-FPLE	1.402
Calaveras_LB	RE-LEVEE-FPLE	0.018
North_Stockton	RE-LEVEE-FPLE	0.059
North_Stockton	RE-FPLE-LS	0.019
North_Stockton	RE-FPLE-WS	0.018
RD_404	RE-LEVEE-FPLE	0.069
RD_404	RE-LEVEE-FPLE	0.072
RD_404	RE-LEVEE-FPLE	1.360
RD_404	RE-LEVEE-FPLE	0.003
RD_404	RE-LEVEE-FPLE	0.001
RD_404	RE-FPLE-WS	0.014

RD_404	RE-FPLE-WS	0.018
RD_404	RE-FPLE-WS	0.002
RD_404	RE-FPLE-WS	0.458
RD_404	RE-FPLE-LS	0.017
RD_404	RE-FPLE-LS	0.018
RD_404	RE-FPLE-LS	0.164
RD_404	RE-FPLE-LS	0.006
RD_404	RE-FPLE-LS	0.001
Delta_Front	RE-LEVEE-FPLE	0.026
Slough_Closure_14Mi	RE-FPLE-CLOSURE-STRUCTURE	0.286
RD_404	RE-LEVEE-FPLE	3.059
Calaveras_LB	RE-LEVEE-FPLE	0.063
Calaveras_RB	RE-LEVEE-FPLE	0.205
Calaveras_LB	RE-LEVEE-FPLE	0.582
North_Stockton	RE-LEVEE-FPLE	0.177
North_Stockton	RE-FPLE-LS	0.088
North_Stockton	RE-FPLE-WS	0.089
North_Stockton	RE-LEVEE-FPLE	0.044
North_Stockton	RE-FPLE-LS	0.020
North_Stockton	RE-FPLE-WS	0.008
Delta_Front	RE-LEVEE-FPLE	0.295
North_Stockton	RE-LEVEE-FPLE	0.035
North_Stockton	RE-FPLE-LS	0.018
North_Stockton	RE-FPLE-WS	0.018
Calaveras_LB	RE-LEVEE-FPLE	0.052
North_Stockton	RE-LEVEE-FPLE	3.774
North_Stockton	RE-FPLE-LS	0.078
North_Stockton	RE-FPLE-WS	1.323
Calaveras_RB	RE-LEVEE-FPLE	0.120
Calaveras_RB	RE-LEVEE-FPLE	0.347
Calaveras_LB	RE-LEVEE-FPLE	0.232
Calaveras_LB	RE-LEVEE-FPLE	0.127
Calaveras_LB	RE-FPLE-WS	0.018
Calaveras_LB	RE-FPLE-LS	0.021
Calaveras_LB	RE-LEVEE-FPLE	0.861
Calaveras_LB	RE-LEVEE-FPLE	0.033
Calaveras_LB	RE-LEVEE-FPLE	8.437
Calaveras_LB	RE-LEVEE-FPLE	1.794
Calaveras_LB	RE-FPLE-WS	0.009
Calaveras_LB	RE-FPLE-LS	0.008
Calaveras_LB	RE-LEVEE-FPLE	2.320
Smith_Canal	RE-FPLE-FLOODWALL	0.120
Smith_Canal	RE-FPLE-CLOSURE-STRUCTURE	0.463
RD_404	RE-FPLE-WS	0.798
RD_404	RE-LEVEE-FPLE	0.737
RD_404	RE-FPLE-LS	0.030
RD_404	RE-LEVEE-FPLE	3.313

RD_404	RE-LEVEE-FPLE	0.022
RD_404	RE-LEVEE-FPLE	0.022
RD_404	RE-LEVEE-FPLE	0.186
RD_404	RE-LEVEE-FPLE	2.915
RD_404	RE-LEVEE-FPLE	0.163
North_Stockton	RE-FPLE-WS	0.043
North_Stockton	RE-FPLE-LS	0.032
North_Stockton	RE-LEVEE-FPLE	0.098
Delta_Front	RE-LEVEE-FPLE	0.288
RD_404	RE-LEVEE-FPLE	0.449
RD_404	RE-LEVEE-FPLE	0.007
Calaveras_RB	RE-LEVEE-FPLE	0.064
RD_404	RE-LEVEE-FPLE	0.141
RD_404	RE-FPLE-WS	0.058
RD_404	RE-LEVEE-FPLE	0.256
RD_404	RE-FPLE-WS	0.143
RD_404	RE-FPLE-LS	0.036
North_Stockton	RE-FPLE-LS	0.020

LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY
REAL ESTATE PLAN

EXHIBIT D

			COST	CNTG (%)		TOTAL FIRST COST
LSJRFS	1 LS	$	61,594,258	38%	$	85,000,000
North Stockton (Conventional SB Cutoff Walls)	1 LS					
02 Relocations	1 LS					
Utilities and Structures	1 LS	$	4,961,299	38%	$	6,847,000
Mob, Demob & Prep Work (assumes 5% of construction)	1 LS	$	220,010	38%	$	304,000
SWPP (assumes 3% of Construction)	1 LS	$	131,452	38%	$	181,000
Traffic Control (assumes 5% of Construction)	1 LS	$	220,010	38%	$	304,000
Utility Fix 3A (Cut and Replace) MC10L Culvert connecting Mosher Slough to Shima Tract (#46 - unknown type or dia - assumes two 48-IN RCP)	1 EA	$	774,731	38%	$	1,069,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#47 - 16-IN Water Main, assumes DIP)	1 EA	$	444,862	38%	$	614,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#48 - 12-IN Water Main, assumes DIP)	1 EA	$	306,170	38%	$	423,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#49 - 12-IN Force Main, assumes CIP)	1 EA	$	362,036	38%	$	500,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#51 - discharge sta, unknown type or dia - assumes two 16-IN WSP)	1 EA	$	1,061,071	38%	$	1,464,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#52 - 12-IN Force Main, assumes CIP)	1 EA	$	328,100	38%	$	453,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC10L (#53 - 12-IN Water Main, assumes DIP)	1 EA	$	272,234	38%	$	376,000
Utility Fix 3C (Cut and Replace - above the DWSE) MC20L (#57 - 4-IN Gas Main, assumes steel pipe)	1 EA	$	108,684	38%	$	150,000
Utility Fix 3A (Cut and Replace - above the DWSE) MC20L (#58 - 15-IN sewer, assumes CIP)	1 EA	$	731,939	38%	$	1,010,000
Delta Front (DSM Cutoff Walls - 3 configurations, SB Cutoff Wall)	1 LS					
02 Relocations	1 LS					
Utilities and Structures	1 LS	$	7,983,759	38%	$	11,018,000
Mob, Demob & Prep Work (assumes 5% of construction)	1 LS	$	352,845	38%	$	487,000
SWPP (assumes 3% of Construction)	1 LS	$	211,707	38%	$	292,000
Traffic Control (assumes 5% of Construction)	1 LS	$	352,845	38%	$	487,000
Utility Fix 3A (Cut and Replace - above the DWSE) TS10L (#35 - 36-IN Force Main, assumes WSP)	1 EA	$	1,129,751	38%	$	1,559,000
Utility Fix 3A (Cut and Replace - above the DWSE) TS10L (#37 - 10-IN Petroleum Pipeline, assumes WSP)	1 EA	$	408,863	38%	$	564,000
Utility Fix 3C (Cut and Replace - above the DWSE) TS10L (#38 - 6-IN Water Line, assumes DIP)	1 EA	$	110,924	38%	$	153,000
Utility Fix 3C (Cut and Replace - above the DWSE) TS10L (#39 - 12-IN Water Line, assumes DIP and 8-IN Sewer Line, assumes CIP)	1 EA	$	647,314	38%	$	893,000

Utility Fix PIPE-L (Cut and Replace) FM30L (#43 - 30-IN Force Main, assumes WSP, assumes runs length of Levee segment)	1 EA	$	1,740,412	38%	$	2,402,000
Utility Fix 3B (Cut and Replace - below the DWSE) FM40L (#44 - 30-IN Force Main, assumes WSP)	1 EA	$	1,265,231	38%	$	1,746,000
Utility Fix 3B (Cut and Replace - below the DWSE) FM60L (#45 - 66-IN Sewer, assumes WSP)	1 EA	$	1,763,866	38%	$	2,434,000
Calaveras River (RB) (Conventional SB Cutoff Walls)	1 LS					
02 Relocations	1 LS					
Utilities and Structures	1 LS	$	17,979,931	38%	$	24,812,000
Mobilization and Demobilization (assumes 5% of construction)	1 LS	$	795,632	38%	$	1,098,000
SWPP (assumes 3% of construction)	1 LS	$	477,379	38%	$	659,000
Traffic Control (assumes 5% of construction)	1 LS	$	795,632	38%	$	1,098,000
Utility Fix PUMP (assumes 3A for Earthwork) (Cut and Replace - above the DWSE) CR30R, LM 24.23 (#33 - four 20-IN, one 12-IN, assumes WSP)	1 EA	$	2,433,237	38%	$	3,358,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR30R, LM 24.20 (#32 - Water Line, assumes 16-IN, DIP)	1 EA	$	281,611	38%	$	389,000
Utility Fix 3A (Cut and Replace - above the DWSE) CR30R, LM 24.19 (#31 - 16-IN Water Line, assumes DIP)	1 EA	$	443,895	38%	$	613,000
Utility Fix PP-L (Utility Pole Relocation) CR40R, LM 23.85-24.14 (#30 - Power Line along Levee)	1 EA	$	32,314	38%	$	45,000
Utility Fix PUMP (assumes 3A for Earthwork) (Cut and Replace - above the DWSE) CR40R, LM 23.77 (#28 - three 30-IN, one 12-IN, assumes WSP)	1 EA	$	2,753,656	38%	$	3,800,000
Utility Fix 4 (Cut and Replace/Relocate - from below DWSE to above the DWSE) CR40R, LM 23.77 (#27 - 33-IN Force Main, assumes WSP)	1 EA	$	1,425,307	38%	$	1,967,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR50R, LM 23 (#24 - 14-IN Discharge Line, assumes WSP)	1 EA	$	205,372	38%	$	283,000
Utility Fix 3A (Cut and Replace - above the DWSE) CR50R, LM 22.76 (#21 - 12-IN Water Line, assumes DIP)	1 EA	$	305,203	38%	$	421,000
Utility Fix 3A (Cut and Replace - above the DWSE) CR50R, LM 22.61 (#20 - two 30-IN discharge pipes, assumes WSP)	1 EA	$	1,223,925	38%	$	1,689,000
Utility Fix 3A (Cut and Replace - above the DWSE) CR50R, LM 22.6 (#19 -18-IN and 24-IN discharge pipes, assumes WSP)	1 EA	$	960,838	38%	$	1,326,000
Utility Fix 3B (Cut and Replace/Relocate - from below DWSE to above the DWSE) CR50R, LM 22.46 (#18 - 14-IN Sewer, assumes WSP)	1 EA	$	1,358,027	38%	$	1,874,000
Utility Fix PP (Utility Pole Relocation) CR60R, LM 22.37 (#15 - Power Pole)	1 EA	$	29,186	38%	$	40,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR70R, LM 21.84 (#6 - two pipes, one 4-IN gas, second unknown utility type, assumes 4-IN gas)	1 EA	$	163,011	38%	$	225,000
Utility Fix PUMP (Cut and Replace - above the DWSE) CR80R, LM 21.21-21.22 (#3 - Pump Station with 2 sets of three pipes, one is 25"-18"-24" steel, second is 36"-25"-36" steel, assumes WSP)	1 EA	$	4,295,708	38%	$	5,928,000
Calaveras River (LB) and North Port San Joaquin River (Conventional SB Cutoff Walls)	1 LS					
02 Relocations	1 LS					
Utilities and Structures	1 LS	$	2,837,442	38%	$	3,916,000

Mob, Demob & Prep Work (assumes 5% of construction)	1	LS	$ 126,000	38%	$	174,000
SWPP (assumes 3% of Construction)	1	LS	$ 75,000	38%	$	104,000
Traffic Control (assumes 5% of Construction)	1	LS	$ 126,000	38%	$	174,000
Utility Fix PP-L, SJR10R (#47 - UG Elec Cable)	1	EA	$ 121,821	38%	$	168,000
Utility Fix 3C (Cut and Replace - above the DWSE) - CR20L, LM 23.69 (#45 - 1-IN Gas Line)	1	EA	$ 62,609	38%	$	86,000
Utility Fix PP, CR40L, LM 21.84-21.89 (#28 Light Pole Relocations)	2	EA	$ 3,189	38%	$	4,000
Utility Fix PP-L, CR40L, LM 21.70 (#27 - Utility Pole Relocations)	1	EA	$ 29,731	38%	$	41,000
Utility Fix 3A (Cut and Replace - above the DWSE) CR40L, LM 21.54 (#25 - 12-IN Water Main, assumes DIP)	1	EA	$ 220,813	38%	$	305,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR40L (#23 - 4-IN Discharge Line, assumes DIP)	1	EA	$ 68,516	38%	$	95,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR40L (#22 - 18-IN sewer, assumes WSP)	1	EA	$ 375,661	38%	$	518,000
Utility Fix 3B (Cut and Replace - below the DWSE) CR40L (#21 - 54-IN sewer, assumes WSP)	1	EA	$ 1,527,622	38%	$	2,108,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR50L, LM 21.16 (#17 - four 5-1/2-IN conduits, unknown utility type, assumes elec 6-IN HDPE)	1	EA	$ 48,349	38%	$	67,000
Utility Fix PP, CR50L, LM 21.08 (#16 - Utility Pole Relocations)	1	EA	$ 28,491	38%	$	39,000
Utility Fix 3C (Cut and Replace - above the DWSE) CR50L, LM 20.95 (#10 - Elec, 6-IN conduit, assumes HDPE)	1	EA	$ 23,641	38%	$	33,000
RD 404 and Duck Creek (Conventianal SB Cutoff Walls)	1	LS				
02 Relocations	1	LS				
Utilities and Structures	1	LS	$ 27,831,827	38%	$	38,408,000
Mob, Demob & Prep Work (assumes 5% of construction)	1	LS	$ 1,230,116	38%	$	1,698,000
SWPP (assumes 3% of Construction)	1	LS	$ 737,516	38%	$	1,018,000
Traffic Control (assumes 5% of Construction)	1	LS	$ 1,230,116	38%	$	1,698,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR30R (#48 - two 36-IN Force Mains, assumes WSP)	1	EA	$ 2,389,686	38%	$	3,298,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR30R (#49 - 24-IN Force Main, assumes WSP)	1	EA	$ 647,364	38%	$	893,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR30R (#50 - 12-IN Force Main, assumes CIP)	1	EA	$ 349,029	38%	$	482,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR30R (#51 - 3 1/2-IN Gas Main, assumes steel pipe)	1	EA	$ 108,274	38%	$	149,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR30R (#53 - 4-IN pipe, assumes Gas line steel pipe)	1	EA	$ 108,274	38%	$	149,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR30R (#54 - Submarine Utility Cable, assumes 4-IN Comm Conduit)	1	EA	$ 25,724	38%	$	35,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR40R, LM 0.35 (#55 - 36-IN pipe, assumes Water Main, WSP)	1	EA	$ 1,137,675	38%	$	1,570,000
Utility Fix 3B (Cut and Replace - below the DWSE) SJR40R, LM 0.7 (#57 - 60-IN RCP Outfall Pipe)	1	EA	$ 930,570	38%	$	1,284,000

Utility Fix 3A (Cut and Replace - above the DWSE) SJR50R, LM 1.06 (#62 - three pipes, util type unknown, assumes water/effluent - two 25-IN, one 60-IN, assumes WSP)	1 EA	$	1,783,746	38%	$	2,462,000
Utility Fix 3B (Cut and Replace - below the DWSE) SJR50R, LM 1.08 (#63 - 36-IN Force Main, assumes WSP)	1 EA	$	1,434,746	38%	$	1,980,000
Utility Fix 3B (Cut and Replace - below the DWSE) SJR50R, LM 1.08 (#64 - sewage outfall pipe, dia unknown, assumes 42-IN, WSP)	1 EA	$	987,896	38%	$	1,363,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR50R, LM 1.08 (#65 - 6-IN pipe - assumes Water Line, assumes DIP)	1 EA	$	229,126	38%	$	316,000
Utility Fix 3B (Cut and Replace - below the DWSE) SJR60R, LM 1.45 (#66 - three effluent pipes - two 25-IN, one 60-IN, assumes WSP)	1 EA	$	2,374,764	38%	$	3,277,000
Utility Fix 2B (Cut and Abandon - below the DWSE) SJR60R, LM 1.48 (#67 - 36-IN pipes, assumes WSP)	1 EA	$	495,307	38%	$	684,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR60R, LM 1.55 (#68 - 3-IN Comm Conduit)	1 EA	$	25,634	38%	$	35,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR60R, LM 1.55 (#69 - Pump Station, one 10-IN, assumes WSP)	1 EA	$	273,964	38%	$	378,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR60R, LM 1.56 (#70 - 16-IN HDPE, unknown utility type, assumes comm since Pac Bell owns)	1 EA	$	287,301	38%	$	396,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR60R, LM 1.57 (#72 - Pump Station, one 10-IN and one 12-IN, assumes WSP)	1 EA	$	782,913	38%	$	1,080,000
Utility Fix 3C (Cut and Replace - above the DWSE) SJR70R, LM 1.76 (#76 - Pump Station, one 8-IN, assumes WSP)	1 EA	$	267,447	38%	$	369,000
Utility Fix PUMP (assumes 3A for Earthwork) (Cut and Replace - above the DWSE) SJR70R, LM 1.85 (#78 - four 24-IN, one 8-IN, assumes WSP) NOT DONE	1 EA	$	2,791,199	38%	$	3,852,000
Utility Fix 3A (Cut and Replace - above the DWSE) SJR70R, LM 1.85 (#79 - Pump Station, one 8-IN, assumes WSP)	1 EA	$	381,152	38%	$	526,000
Utility Fix 3B (Cut and Replace - below the DWSE) FCS10R, LM 0.22 (#81 - abandoned 8-IN, two effluent pipes - two 27-IN, one 12-IN sewer, assumes WSP)	1 EA	$	3,240,733	38%	$	4,472,000
Utility Fix 3A (Cut and Replace - above the DWSE) FCS10R, LM 0.77 (#82 - 6-IN pipe - assumes intake line, 18-IN & 3-IN assumes discharge)	1 EA	$	1,508,105	38%	$	2,081,000
Utility Fix 2A (Cut and Abandon - above the DWSE) FCS10R, LM 0.78 (#83 - abandoned pipes 8-IN and 4-IN, assumes WSP)	1 EA	$	62,351	38%	$	86,000
Utility Fix 3C (Cut and Replace - above the DWSE) FCS10R, LM 1.09 (#87 - 3-IN Comm Conduit)	1 EA	$	25,634	38%	$	35,000
Utility Fix 2A (Cut and Abandon - above the DWSE) FCS10R LM 1.18 (#88 - two abandoned 6-IN, assumes DIP)	1 EA	$	60,572	38%	$	84,000
Utility Fix 3C (Cut and Replace - above the DWSE) FCS10R, LM 1.7 (#91 - Pump Station, one 6-IN, assumes WSP)	1 EA	$	263,066	38%	$	363,000
Utility Fix 3B (Cut and Replace - below the DWSE) DC10R (#94 -24-IN discharge pipes, assumes WSP)	1 EA	$	1,269,570	38%	$	1,752,000
Utility Fix 3A (Cut and Replace - above the DWSE) DC10R (#95 - Fiber Optic Cable, 2-IN HDPE conduit)	1 EA	$	66,587	38%	$	92,000
Utility Fix PP-L, DC20R (#96 - Utility Pole Relocations)	7 EA	$	190,658	38%	$	263,000
Utility Fix PP, DC30R (#97 - Utility Pole Relocations)	5 EA	$	135,011	38%	$	186,000

02 Relocations	$ 61,594,258	38%	$	85,000,000
30 & 31 PED	$ 16,990,601	38%	$	23,447,000
TOTAL (02, 30, 31)	$ 78,584,859		$	108,447,000