2.0 Program Description

The State Systemwide Investment Approach (SSIA) described in the CVFPP is the proposed program evaluated in this PEIR. (Additional information about alternatives to the proposed program is provided in Chapter 5.0, "Alternatives.") The proposed program sets the long-term policy direction for a wide range of possible future actions while enabling flexibility in addressing changing needs and funding scenarios. It consists of a programmatic set of broadly described management actions that the State can implement as part of the CVFPP, with a focus on lands protected by facilities of the State Plan of Flood Control (SPFC). The proposed program includes recommendations for improving the flood management system, along with the policies and institutions that support management of flood risks, from a systemwide perspective.

The proposed program is described in detail in the public draft of the 2012 CVFPP made available in December 2011. The description below is a summary of the principal features of the proposed program that are relevant to the environmental analysis in Chapter 3.0 of this PEIR. In some areas, program features are simplified or paraphrased for ease of use. For a more comprehensive description of the proposed program, please refer to the CVFPP, which is included as Appendix A to this PEIR.

2.1 Purpose and Objectives of the Proposed Program

This section describes the purpose of the proposed program and the objectives guiding its development and implementation.

2.1.1 Program Purpose

The broad purpose of the proposed program is to respond to the California Legislature's direction in the Central Valley Flood Protection Act of 2008 (Senate Bill (SB) 5) to develop and implement a sustainable, integrated flood management plan for the Central Valley. In taking an integrated flood management approach, the proposed program recognizes that flood management is connected to water resource management; land use planning; environmental stewardship; and long-term economic, environmental, and social sustainability. Integrated flood management also recognizes the importance of evaluating opportunities and potential impacts

from a systemwide perspective, and the importance of coordinating across geographic and agency boundaries to treat hydrologic units.

The proposed program would be implemented over time by the State, federal agencies, and local agencies such as reclamation districts, municipal and regional flood management agencies, and cities and counties.

The CVFPP is part of a long-term planning effort and is to be updated every 5 years. As the first edition of the plan, the 2012 CVFPP does the following:

1. Describes a broadly supported vision for improving flood management in the Central Valley

2. Recommends initial management actions to reduce flood risks

3. Identifies potential modifications to the flood management system for further study

4. Describes a framework for implementing future improvements

5. Describes a framework for developing a conservation strategy for the flood system

Adoption of the CVFPP (which describes the SSIA—that is, the proposed program) by the Central Valley Flood Protection Board (Board) would provide the general direction for long-term implementation of improvements to the Central Valley's flood management system. The proposed program sets the broad policy direction for a wide range of possible future actions while enabling flexibility to address changing needs.

The proposed program outlines broad management actions (many of which may be "projects" under the California Environmental Quality Act (CEQA)) that can improve systemwide management of flood risks. The program also integrates environmental conservation strategies and actions that would improve the flood management system's long-term sustainability and improve ecosystem function. In addition, it provides options for addressing compliance with environmental regulations associated with long-term operation and maintenance.

The proposed program includes broad management actions, including policies and programs that can be combined to achieve the goals of the CVFPP (i.e., program objectives). The program also includes specific management actions for various geographic areas so that the systemwide benefits of implementation can be assessed. Specific actions are described and analyzed to enable coherent analyses of the proposed program;

however, the actual evolution of the CVFPP would depend largely on the independent decisions of federal, State, and local cooperating and regulatory agencies, as well as the availability of funding. Follow-on feasibility studies and CVFPP updates are expected to further refine the proposed program and assess the potential costs, benefits, and impacts of site-specific implementation projects. Therefore, the proposed program is analyzed in the PEIR at a programmatic level, reflecting the potentially broad range and scale of future CVFPP-based implementation actions and their potential impacts.

2.1.2 Program Objectives

Eight program objectives were formulated to guide development of this PEIR, and a reasonable range of alternatives to be evaluated in the PEIR. Five of these objectives address the underlying goals of the proposed program: a primary objective to improve flood risk management, and supporting objectives to improve operations and maintenance, promote ecosystem functions, improve institutional support, and promote multi-benefit projects. The remaining three program objectives guiding this PEIR reflect direction provided in the authorizing legislation (summarized in Chapter 1.0, "Introduction"): maximize flood-risk reduction benefits within the practical constraints of available funds; adopt the CVFPP by July 1, 2012; and promote as feasible the multiple objectives provided in California Water Code (CWC) Section 9616. These objectives are presented below.

Primary Objective

- **Improve Flood Risk Management—**Reduce the chance of flooding and damages, once flooding occurs, and improve public safety, preparedness, and emergency response through the following:
  - Identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC.
  - Formulating standards, criteria, and guidelines to facilitate implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin river basins and the Delta.

Supporting Objectives

- **Improve Operations and Maintenance—**Reduce systemwide maintenance and repair requirements by modifying the flood management systems in ways that are compatible with natural processes, and adjust, coordinate, and streamline regulatory and

institutional standards, funding, and practices for operations and maintenance, including significant repairs.

- **Promote Ecosystem Functions—**Integrate the recovery and restoration of key physical processes, self-sustaining ecological functions, native habitats, and species into flood management system improvements.

- **Improve Institutional Support—**Develop stable institutional structures, coordination protocols, and financial frameworks that enable effective and adaptive integrated flood management (designs, operations and maintenance, permitting, preparedness, response, recovery, and land use and development planning).

- **Promote Multi-Benefit Projects—**Describe flood management projects and actions that also contribute to broader integrated water management objectives identified through other programs.

Statutory Objectives

- **Maximize Flood Risk Reduction Benefits within the Practical Constraints of Available Funds**—Ensure that technically feasible and cost-effective solutions are implemented to maximize the flood risk reduction benefits given the practical limitations of available funding, and provide a feasible, comprehensive, and long-term financing plan for implementing the plan.

- **Adopt the CVFPP by July 1, 2012**—Complete all steps necessary to develop and adopt the CVFPP by July 1, 2012, or such other date as may be provided by the Legislature.

- **Meet Multiple Objectives Established in Section 9616 of the California Water Code, as Feasible**:

  Reduce the risk to human life, health, and safety from flooding, including protection of public safety infrastructure.

  Expand the capacity of the flood management system in the Sacramento–San Joaquin Valley[1] *to either reduce flood flows or convey floodwaters away from urban areas.*

[1] California Government Code (CGC) Section 65007(g) defines the Sacramento–San Joaquin Valley as follows: *"Sacramento–San Joaquin Valley" means any lands in the bed or along or near the banks of the Sacramento River or San Joaquin River, or any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow there from. The*

Link the flood protection system with the water supply system.

Reduce flood risks in currently nonurbanized areas.

Increase the engagement of local agencies willing to participate in improving flood protection, ensuring a better connection between State flood protection decisions and local land use decisions.

Improve flood protection for urban areas to the urban level of flood protection.

Promote natural dynamic hydrologic and geomorphic processes.

Reduce damage from flooding.

Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.

Minimize flood management system operations and maintenance requirements.

Promote the recovery and stability of native species' populations and overall biotic community diversity.

Identify opportunities and incentives for expanding or increasing use of floodway corridors.

Provide a feasible, comprehensive, and long-term financing plan for implementing the CVFPP.

Identify opportunities for reservoir reoperation in conjunction with groundwater flood storage.

2.2 Development of the Proposed Program

This section describes the development, key implications, and characteristics of the proposed program.

Sacramento–San Joaquin Valley does not include lands lying within the Tulare Lake basin, including the Kings River."

2.2.1 Management Actions and Development of the Preliminary Approaches

The proposed program is founded on over 100 years of planning and flood system improvement efforts in the Central Valley, and in many respects reflects a continuation of those efforts. The CVFPP, however, for the first time compiles and elaborates on those efforts in a unified public document reflecting considerable public input and the requirements established by the California Legislature in SB 5.

DWR's development of the proposed program began with the identification of a comprehensive array of individual management actions to address one or more of the program objectives. Management actions are building blocks that can be combined in different ways to form systemwide solutions that collectively address all objectives of the proposed program. Some management actions are physical, place-based actions that would involve constructing facilities or otherwise physically modifying the flood management system's operation or maintenance (e.g., levee modifications, new floodwater storage, or environmental restoration). Other management actions address policies, guidance, or institutional arrangements and could apply throughout the Central Valley (e.g., amendments to building codes, changes to financing mechanisms and permitting processes).

The management actions were evaluated based on their technical, environmental, social, and economic characteristics and classified based on their ability to contribute to the objectives of the proposed program. Partners and interested parties participated in development of management actions through participation in regional work groups and public workshops. Ultimately, 94 management actions were retained for further development and consideration in the proposed program (see Appendix B, "2012 Central Valley Flood Protection Plan: Management Actions Report"). The retained management actions generally fall into the following broad categories or types of actions:

- Additional floodplain and reservoir storage
- Storage operations
- Modifications to the flood protection system
- Operations and maintenance
- Ecosystem functions
- Floodplain management

- Disaster preparedness and flood warning
- Flood fighting, emergency response, and flood recovery
- Policies and regulations
- Permitting
- Finance and revenue

This PEIR focuses on those management actions with the potential to result in environmental effects, generally being those actions involving the construction, modification, operation or maintenance of physical facilities.

Given the large geographic scope and range of perspectives on solutions to flood management problems in the Central Valley, thousands of potential alternatives could have been formed from combining individual management actions. Consequently, DWR developed a methodology to reduce the number of possible permutations to a manageable level while still representing the full range of approaches to achieving the objectives of the proposed program. This methodology resulted in identification of three fundamentally different preliminary approaches (referred to as "alternatives" in this PEIR) that satisfy the program objectives in different ways and to varying degrees. As summarized below, these preliminary alternatives are the Achieve SPFC Design Flow Capacities Alternative, Protect High-Risk Communities Alternative, and Enhance Flood System Capacity Alternative.

- **Achieve SPFC Design Flow Capacities Alternative—**The Achieve SPFC Design Flow Capacity Alternative focuses on addressing the condition of existing SPFC levees so that the channels convey their design flows with a high degree of reliability based on current engineering criteria. The system was largely constructed based on geometric criteria using available soil materials without extensive investigation of foundation conditions. The majority of SPFC levees do not meet current engineering criteria. This alternative addresses an element of the authorizing legislation (CWC Section 9614(g)), which requires that DWR evaluate structural projects that could be undertaken to reconstruct SPFC facilities to bring each of the facilities of the SPFC to within its design standard. This alternative involves addressing levee conditions primarily in place, without making major changes to the footprint or operation of those facilities. Levee improvements would be made regardless of the areas they protect or the level of protection they provide. This alternative would provide little opportunity to incorporate benefits beyond flood management.

- **Protect High-Risk Communities Alternative—**The Protect High-Risk Communities Alternative evaluates improvements to levees to protect life safety and property for high-risk population centers, including urban and small communities. Most levees in rural-agricultural areas would remain in their existing configurations; however, new training levees, ring levees, or floodwalls immediately adjacent to the communities may be constructed. This alternative would provide a minor opportunity to incorporate benefits beyond flood management.

- **Enhance Flood System Capacity Alternative—**The Enhance Flood System Capacity Alternative involves seeking opportunities to achieve multiple benefits by enhancing the flood system's storage and conveyance capacity, protecting high-risk communities, and fixing levees in place in rural-agricultural areas. This alternative combines the features of other alternatives and provides greater capacity within flood conveyance channels to lower flood stages in most of the system.

These are three of the alternatives considered in Chapter 5.0, "Alternatives," of this PEIR. Others are the Modified State Systemwide Investment Alternative, Achieve SPFC Design Flow Capacity with Strict Engineering Technical Letter (ETL) Compliance Alternative, the No-Project Alternative—Continued Operations Scenario, and the No-Project Alternative—No Additional Activities Scenario. See Chapter 5.0 for a full description of the alternatives.

2.2.2 Key Implications for the Proposed Program

Evaluating and comparing the preliminary alternatives highlighted various findings and implications that informed DWR's development of the proposed program. Key implications are summarized below.

- Levels of flood protection should be commensurate with risk within the floodplains.

- Investments should not increase flood risk.

- Investments should promote actions that increase system flexibility and the ability to accommodate and attenuate large flood peaks.

- High operations and maintenance costs are driven in part by the current footprint of the levee system, which, at many locations, is at odds with natural geomorphic processes.

- To fully realize efficient and sustainable operations and maintenance over the long term, the State should consider changes to institutional arrangements, practices, and funding.

- A comprehensive approach should develop and implement policies and programs that help manage residual risks that remain after improvement projects are implemented.

- Systemwide and regional (urban, small-community, and rural-agricultural) elements representing proposed flood management system improvements both have roles in the proposed program.

- Central Valley cities and counties that wish to continue to develop in urban areas are required to achieve an urban level of flood protection (protection against the 200-year or 0.5-percent-chance flood), as defined in California Government Code (CGC) Section 65007(l) and CWC Section 9602(i). The State supports achieving an urban level of flood protection, at a minimum, for all existing urban and urbanizing areas in the Systemwide Planning Area (SPA). Where feasible, the State supports considering higher levels of flood protection, particularly for urban/urbanizing areas in deep floodplains (greater than 3 feet of flooding during a 200-year flood).

- From a systemwide perspective, it is in the State's interest to support the continued viability of small communities within the SPA to preserve cultural and historical continuity and important social, economic, and public services to rural-agricultural populations, agricultural enterprises, and commercial operations.

- As specified in CGC Sections 65865.5, 65962, and 66474.5, new development in nonurbanized areas, including small communities, must meet the standard of flood protection established by the Federal Emergency Management Agency (FEMA). This corresponds to the minimum level of flood protection (protection against the 100-year or 1-percent-chance flood) required for participation in the National Flood Insurance Program.

- Many rural-agricultural areas will benefit from systemwide elements of the proposed program, which provide direct flood risk reduction benefits to rural-agricultural areas by lowering flood stages and more efficiently moving floods through the system.

- While the State supports improving rural-agricultural flood protection to foster and support economic viability, such improvements should be done in a way that minimizes the potential for being growth inducing.

- The State supports using corridor management planning approaches to develop integrated, multi-benefit projects.

- State and local- proposed changes and reforms to FEMA's flood insurance program are expected to support a vibrant agricultural economy in rural-agricultural areas that do not have protection from a 100-year (1-percent-annual-chance) flood.

- The State supports implementing integrated projects to achieve multiple benefits, including environmental conservation and restoration, agricultural conservation, water supply and quality, and related benefits.

- Recognizing the benefits to both public safety and the ecosystem, the State has a great interest in integrated environmental stewardship and flood management to leverage investments and associated benefits.

- All levels of project planning and development need to consider opportunities to integrate ecosystem enhancements with flood damage reduction projects.

- The State should encourage programs that provide incentives for including ecosystem improvements and other multiple benefits to projects, as outlined in CWC Section 12585.7.

As described in the CVFPP, the most promising elements from the preliminary alternatives were combined to form the State Systemwide Investment Alternative, which is the proposed program evaluated in this PEIR.

2.3 Characteristics and Key Components of the Proposed Program

The proposed program reflects the State's vision for modernizing the SPFC to address current challenges and future trends and to meet the proposed program's objectives (as described in Section 2.1.2, "Program Objectives"). Flooding poses different threats to the people, critical infrastructure, and properties associated with the valley's varied land uses; consequently, the proposed program embodies a differentiated approach to improving flood protection in urban areas, small communities, and rural-agricultural areas. Integrating the conservation and restoration of ecosystem functions and habitats in flood management actions, where feasible, is an important strategy for meeting the objectives of the proposed program.

The key characteristics of the proposed program are organized into the following regional and system categories: urban, small-community, and rural-agricultural area flood protection; system improvements; non-SPFC

levees; and integration of ecosystem restoration opportunities with flood risk reduction projects. This section then discusses the vegetation management strategy (VMS) and life-cycle management (LCM), local planning obligations, regional planning, and early implementation and other accomplishments of the past 5 years.

2.3.1 Urban Flood Protection

The proposed program would improve levees that protect existing urban areas (with populations greater than 10,000) to achieve at least an urban level of flood protection (protection against a 0.5-percent-chance event). With some exceptions, existing SPFC levees in urban areas are often located immediately adjacent to houses and businesses, leaving few opportunities to set levees back or make improvements that enlarge levee footprints. Therefore, reconstruction of existing urban levees is generally the method for increasing flood protection.

Improvements to urban levees or floodwalls would follow DWR's *Urban Levee Design Criteria* (anticipated 2012), at a minimum. The State strongly supports considering features that offer greater system resilience, such as levees that can withstand overtopping without catastrophic breaching. Another option is to build compartmentalized floodplains—that is, to use secondary levees, berms, or elevated roadways in protected areas to reduce the geographic extent of flooding when a failure occurs.

Levee setbacks would be considered for projects in urban areas, to the extent feasible, based on the level of existing development and the potential benefits. These levee projects would also preserve and/or restore, at minimum, shaded riparian habitat corridors along the waterside toe of levees. Ecosystem preservation, restoration, and enhancements may be incorporated into project designs. Urban improvements should also be implemented and maintained consistent with the State's VMS (see Section 2.4.3, "Other Near-Term Management Activities," below, and Appendix E, "2012 Central Valley Flood Protection Plan Conservation Framework").

The proposed program does not include improvements that may be needed to address interior drainage or other local sources of flooding. The State could pursue improvements to non-SPFC levees that protect some urban areas (see Section 2.3.5, "Non–State Plan of Flood Control Levees") even though the State has no responsibility for these levees at this time. The decision to add these levees to the SPFC would require Board action. Alternatively, the State may choose to participate in funding levee reconstruction or improvements, if found to be feasible.

2.3.2 Small-Community Flood Protection

The proposed program would reduce flood risk in existing small communities (with populations less than 10,000), where feasible. The State would evaluate what level of investments to make to preserve development opportunities in small communities without providing an urban level of flood protection. Additional State investments in small-community protection would be prioritized based on relative community flood-threat levels, considering factors such as population, the likelihood of flooding, proximity to the flooding source, and depth of flooding. Other factors considered in prioritizing flood protection improvements for small communities include financial feasibility and achievement of the proposed program objectives to promote multiple benefits.

In general, the State would consider implementing the following structural and nonstructural actions to protect small communities in the SPFC Planning Area from a 100-year (1-percent-chance) flood:

- Protect small communities "in place" using ring levees, training levees, or floodwalls when improvements do not exceed a certain predetermined threshold. The threshold would be determined after additional feasibility study and consultation with the communities.

- Reconstruct or improve adjacent SPFC levees.

- When the in-place improvements described above are not feasible, implement nonstructural improvements such as raising/elevating structures, floodproofing,[2] purchasing land and structures, and/or relocating structures.

In some cases, small communities may achieve flood protection as part of adjacent urban improvements.

Improvements in small communities should also be implemented and maintained consistent with the State's VMS (see Section 2.3.7, "Vegetation Management Strategy and Life-Cycle Management," and Appendix E, "Central Valley Flood Protection Plan Conservation Framework"). Ecosystem preservation, restoration, and enhancements may be incorporated into project designs.

[2] Floodproofing can include any combination of structural and nonstructural additions, changes, or adjustments to structures that reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures, and their contents (FEMA 2011).

2.3.3 Rural-Agricultural Area Flood Protection

The proposed program's levee improvements for rural-agricultural areas would not be as extensive as those for urban areas and small communities, reflecting the lower levels of development within these floodplains.

The State recognizes that federal engineering guidance and design standards may result in cost-prohibitive levee repairs for many rural-agricultural areas. The State will work with rural-agricultural communities to develop applicable repair standards for SPFC levees. The State will also evaluate what level of investments to make to preserve rural-agricultural activities that discourage incompatible development and encourage compatible development within floodplains.

Flood-risk-reduction projects in rural-agricultural areas that can achieve multiple resource benefits are preferable to single-purpose projects, and are likely to be encouraged through enhanced State and federal cost-sharing. Shaded riverine aquatic habitat, wetlands, and other habitat may be preserved and restored, to the extent practical, as part of the design of projects to reconstruct SPFC facilities. This includes protection and enhancement of existing healthy ecological communities, in addition to the enhancement/restoration of degraded ecosystem services and functions.

The proposed program would improve flood management in rural-agricultural areas by implementing a variety of measures:

- Improvements to SPFC levees in rural-agricultural areas would focus on maintaining levee crown elevation and providing all-weather access roads to facilitate inspection and flood fighting.

- Levee improvements, including setbacks, may be used to resolve known performance problems (such as erosion, boils, slumps/slides, and cracks). Projects involving reconstruction of rural SPFC levees would be evaluated for their potential to address identified threat factors, particularly in combination with small-community protection, where economically feasible.

- Agricultural conservation easements that preserve agriculture and prevent urban development in agricultural areas may be purchased, when consistent with local land use plans.

- Existing hydraulic structures may be upgraded based on facility age or operational problems.

- The State would evaluate potentially removing (physically or administratively) facilities of the SPFC in rural areas, including rock

revetment, levee, and other facilities, consistent with criteria presented in the CVFPP. Until another federal process for removing SPFC facilities is defined, administrative removal would require an act of Congress.

2.3.4 System Improvements

System improvements are physical actions or improvements with the potential to benefit large portions of the flood management system, and improve the overall function and performance of the SPFC in managing large floods. These actions would enhance the system's overall ability to convey and attenuate flood peaks through expansion of bypass capacity and storage features. System improvements provide flood protection benefits to urban, small-community, and rural-agricultural areas by lowering flood stages.

These actions also present substantial opportunities to improve ecosystem functions and continuity on a systemwide level. System improvements would also be implemented and maintained consistent with the State's VMS (see Section 2.3.7, "Vegetation Management Strategy and Life-Cycle Management," and Appendix E, "Central Valley Flood Protection Plan Conservation Framework").

The proposed program would improve the ability of the SPFC to convey large flood events through modified (or potentially new) weirs, bypass systems, hydraulic structures, and easements. These actions would increase the conveyance capacity of the flood system, reduce peak flood elevations, and accommodate restoration of ecosystem processes. Changing the operations of existing weirs and bypasses, reservoirs, or other flood management facilities also has the potential to contribute to the performance of the SPFC and provide additional system resiliency.

The proposed program would consider capturing and using flood flows for groundwater recharge as a component of integrated flood and water management for the proposed program. The State recognizes that there are limitations to groundwater recharge (e.g., inadequate groundwater storage capacity and low recharge rates in comparison with large flood flows). Considering these limitations, the proposed program provides opportunities for in-channel groundwater recharge and, although not recommending any specific recharge projects at this time, encourages exploring recharge opportunities where feasible.

Most major reservoirs in the Central Valley have been designed and built to meet multiple purposes, including water supply, recreation, and flood control. These multipurpose reservoirs have defined operations to capture winter and spring runoff for water supply, and designated flood control

space to manage flood flows. Multipurpose reservoirs allocate portions of storage space to different purposes, and rely on operational rules to maintain these reservations. Operational changes could benefit flood risk reduction and the ecosystem. Implementation would include both the Forecast-Coordination Operations (F-CO) and Forecast-Based Operations (F-BO) programs. Changes would be implemented in ways that would not substantially affect water supply reliability or deliveries, power production, or other program purposes (see Section 2.6, "No Near- or Long-Term Reduction in Water or Renewable Electricity Deliveries"). DWR will consider willing partnerships with reservoir operators to accomplish program objectives.

The ultimate configuration of facilities will be known only after future feasibility studies have explored the potential magnitude and extent of hydraulic impacts from improvements within the system. Features to mitigate hydraulic impacts may include the following:

- Levee enhancements for affected areas
- New surface storage partnerships with willing reservoir operators
- New transitory storage
- Modification of project designs to limit stage increases
- Other features that appear promising during feasibility studies.

2.3.5 Non–State Plan of Flood Control Levees

Approximately 420 miles of private non-SPFC levees are closely associated with SPFC levees, of which about 120 miles work in conjunction with SPFC levees to provide protection to urban areas. Non-SPFC levees are those (1) that abut SPFC levees, (2) whose performance may affect the performance of SPFC levees, or (3) that provide flood risk reduction benefits to areas also being protected by SPFC features.

The State recognizes that for an urban area protected jointly by both SPFC and non-SPFC levees, the legislated requirement for an urban level of flood protection (200-year or 0.5-percent-annual-chance flood) requires that both types of facilities be improved. During future feasibility studies, the State will evaluate projects to maintain the function of local levees (not part of the SPFC) if they contribute to the effective operations and maintenance of the SPFC. The Board may choose to treat some or all these non-SPFC levees in a similar manner to SPFC urban levees for State participation in levee improvements, and potentially add them to the SPFC. Alternatively, if the Board chooses not to add these levees to the SPFC, the State will

consider participating in improvements to these levees under other State programs.

Non-SPFC nonurban levees are not included in the proposed program. Portions of these non-SPFC nonurban levees may be candidates for being added to the SPFC after preparation of regional plans and feasibility studies (see Section 2.3.5, "Non–State Plan of Flood Control Levees"), but DWR has not included them as part of the proposed program. However, the State reserves the right to invest in these levees if studies demonstrate a system-wide benefit or otherwise determine that they should be part of the SPFC.

In addition, completed and ongoing Early Implementation Projects initiated since bond funding became available in 2007 on non-SPFC levees may be added to the SPFC when final documentation is complete.

2.3.6 Integrating Ecosystem Restoration Opportunities with Flood Risk Reduction Projects

In taking an integrated flood management approach, the intent of the proposed program would be to make progress on improving ecological conditions on a systemwide basis, using integrated policies, programs, and projects. This approach builds on and advances ongoing efforts and successes to incorporate environmental benefits into flood management projects. Integrating environmental stewardship early into policy and project planning, development, and implementation will help move beyond traditional project-by-project compensatory mitigation. This approach also creates the opportunity to develop flood management projects that may be more sustainable and cost-effective, and can provide ecological benefits while protecting public safety. Under the proposed program, ecosystem restoration opportunities are integral parts of system improvements, as well as urban, small-community, and rural-agricultural area flood protection projects.

Appendix E, "Central Valley Flood Protection Plan Conservation Framework," focuses on promoting ecosystem functions and multi-benefit projects in the context of integrated flood management for near-term implementation. The Conservation Framework provides an overview of the floodway ecosystem conditions and trends and key conservation goals that further clarify the proposed program's ecosystem goal. The Conservation Framework also identifies opportunities for integrated flood management projects that, in addition to improving public safety, can enhance riparian habitats, provide connectivity of habitats, restore riparian corridors, improve fish passage, and reconnect the river and floodplain.

Consistent with the Conservation Framework, the proposed program's opportunities for ecosystem restoration and enhancement include the following:

- **Regional improvements (urban, small-community, and rural-agricultural areas)—**Flood protection projects will preserve important shaded riparian aquatic habitat along riverbanks and help restore the regional continuity/connectivity of such habitats. Planning and designs for flood risk reduction projects will consider opportunities to enhance ecosystem functions.

- **System improvements—**DWR, through its multiple programs, will continue to work on integrated flood management projects within the SPA, and will evaluate and where feasible initiate other projects that benefit the SPFC. Sutter and Yolo bypass expansions (described previously) may increase the overall area of floodplain that would support wetland habitats.

- **Fish passage improvements—**DWR will evaluate and where feasible initiate improvements to fish passage at SPFC weirs, bypasses, and other flood management facilities undergoing modification or rehabilitation to improve access to upstream aquatic habitat and facilitate natural flow routing.

DWR's goal in integrating ecosystem restoration and enhancement is to achieve overall habitat improvement, thereby reducing, or eliminating the need to mitigate for most ecosystem impacts. In many areas, the CVFPP anticipates a net benefit of the program to aquatic and terrestrial species. At a minimum, mitigation performance standards established in this PEIR will be applied, generally requiring that mitigation avoid a net overall loss of habitat values. All projects will also comply with all applicable permitting and other regulatory requirements. However, despite the fact that the program is intended to provide net benefits overall, depending on the timing of improvements and implementation, some ecosystem mitigation may be required.

2.3.7 Vegetation Management Strategy and Life- Cycle Management

Levee vegetation management practices and procedures are an important component of the Flood Protection Operations and Maintenance Program, and of numerous ongoing and proposed flood risk reduction projects. These practices and procedures require a careful balancing of public safety and environmental considerations. The State's priority is to improve public safety by providing for levee integrity, visibility, and accessibility for inspections, maintenance, and flood fight operations. However, these

practices and procedures must also consider the fact that the levees that confine today's river systems in California are holding the last remnants of a once great riparian forest ecosystem that dominated the Central Valley. Many of California's fish and wildlife resources, such as Swainson's hawk and valley elderberry longhorn beetle, evolved in this complex and diverse natural community and are listed as State or federal threatened or endangered species due to the cumulative loss of habitat along riparian corridors.

Unlike levees in many other areas of the country, most of the SPFC levees were built close to the existing riverbanks. This approach was designed principally to confine river flows in order to mobilize the massive quantities of sediment generated by hydraulic gold mining in the late 1800s. Although generally successful in helping attain this goal, the approach also resulted in the loss of substantial amounts of riparian habitat, leaving the situation much as we find it today.

Much of the vegetation currently present on Central Valley levees was present when the State took over responsibility for the system in 1955. Over the years, the U.S. Army Corps of Engineers (USACE) and the State reached an agreement on how trees and other vegetation can coexist with the public safety function of levees in the Central Valley. This agreement was memorialized in maintenance manuals for the Sacramento and San Joaquin systems, which allow the retention of well-maintained vegetation on levees. These manuals, in turn, implemented a USACE "vegetation variance letter" dated August 3, 1949, which revised its Standard Operations and Maintenance Agreement to include the following text: "Brush and small trees may be retained on the water side slope where desirable for the prevention of erosion and wave wash. Where practicable, measures shall be taken to retard bank erosion by the planting of willows or other suitable growth on areas riverward of the levees." Over the years, USACE practice was to protect trees while performing levee repairs on Central Valley levees, and to require new tree planting in its levee designs, where feasible.

In early 2007, USACE began to revisit its policy toward levee vegetation, by releasing a "white paper" proposing a nationwide VMS that would require the removal of all woody vegetation from all levee slopes and toe areas. In response, the State and other levee maintaining agencies objected that such a nationwide "one-size-fits-all" approach would fail to appropriately consider the environmental values offered by riparian vegetation in the Central Valley, would divert scarce resources away for more critical safety issues, and would not provide a net public safety benefit.

This position has recently been confirmed in one of the findings of the *Flood Control System Status Report* (DWR 2011)—that levee vegetation is a low threat to levee integrity in comparison with other risk factors. This is consistent with the fact that, with many levee failures in California, none have been attributed to vegetation. It is also generally consistent with more recent findings of a research report by the USACE Engineer Research and Development Center (USACE 2010) that show that woody vegetation has the potential to increase or reduce risk, depending on a variety of factors.

In August 2007, seeking to resolve these differences, DWR, USACE, local maintaining agencies, and key federal and State resources agencies commenced cooperative discussions in the California Levees Roundtable. Shortly thereafter, DWR in October 2007 adopted "Interim Vegetation Inspection Criteria" that involve no vegetation removal other than as necessary for critical safety reasons on the waterside of levees more than 20 feet below the crown. Above that point on the waterside, on the crown, and on the landside of the levee (the vegetation management zone), vegetation would be removed to provide for visibility and access.

The cooperative California Levees Roundtable discussions led to the *California's Central Valley Flood System Improvement Framework* (Framework Agreement), dated February 27, 2009 (California Levees Roundtable 2009). The Framework Agreement would allow Central Valley levees to retain acceptable maintenance ratings and Public Law 84-99 rehabilitation eligibility as long as levee trees and shrubs are properly trimmed and spaced to allow for visibility, inspection vehicles, and flood fight access, generally as described in the October 2007 interim DWR criteria. The Framework Agreement also states that this approach "will be reconsidered based on the contents of the CVFPP."

Shortly thereafter, however, USACE issued ETL 1110-2-571, which finalized its *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*. These guidelines essentially adopted the approach proposed in the 2007 white paper by establishing a woody vegetation-free zone on all levees and the adjoining ground within 15 feet of the levee on both sides. As an implementation directive for the ETL, USACE subsequently issued a draft Policy Guidance Letter (PGL), *Variance from Vegetation Standards for Levees and Floodwalls* (February 9, 2010) and additional findings on February 17, 2012. DWR and the California Department of Fish and Game memorialized their objections to the vegetation removal requirements of the ETL and PGL in an April 15, 2010, letter to USACE.

Generally, DWR believes that the approach initiated in its October 2007 interim criteria, as memorialized in the Framework Agreement, reflects a

better balance between public safety and environmental considerations than that reflected in the ETL and PGL. Accordingly, this approach has been carried forward in the CVFPP as the VMS.

DWR and other maintaining agencies began undertaking maintenance in accordance with the 2007 interim inspection criteria and the 2009 Framework Agreement shortly after their adoption. As reflected in the December 2011 *Flood Control System Status Report* (DWR 2011), attached to the draft CVFPP, based on site inspections through July 2010, all but approximately 15 miles of the SPFC levees are now compliant with this component of the VMS.

USACE, however, has suggested that more would be required to qualify for a variance from the more extensive vegetation removal requirements of the ETL. In response, DWR has included an additional vegetation management component in the CVFPP labeled LCM. LCM involves additional focused efforts to ensure that new trees do not become established on those portions of SPFC levees in the vegetation management zone described above. Under LCM, existing trees not posing an unacceptable safety hazard will be allowed to remain, but will not be replaced upon their deaths. Over time, the LCM component of the VMS would result in the gradual elimination of this large woody vegetation from the portions of SPFC levees within the vegetation management zone. Even with the proposed LCM, there would be no vegetation removal other than as necessary for critical safety reasons on the waterside of levees more than 20 feet below the crown. The habitat losses resulting from LCM would be compensated for by the early planting of additional riparian forests as described below.

The VMS, including the proposed LCM component and riparian forest planting, is described in greater detail below in Section 2.4.3, "Other Near-Term Management Activities." DWR believes that this approach reflects the best balance of public safety and environmental considerations, and is an appropriate basis for the issuance by USACE of a variance from the ETL's far more extensive vegetation removal requirements.

2.3.8 Local Planning Obligations

The CVFPP recognizes that development behind levees is often incompatible with periodic flooding, to the detriment of public safety and floodplain ecosystems, unless special measures, such as elevating or floodproofing buildings, are implemented to limit damages. The plan therefore broadly discourages incompatible development, and encourages compatible development, within floodplains. Beyond those broad policies however, the CVFPP does not directly impose local planning obligations.

The 2007 flood legislation, however, imposes several planning and development approval obligations on certain cities and counties, as generally described in DWR's October 2010 *Implementing California Flood Legislation into Local Land Use Planning: A Handbook for Local Communities.* First, under CGC Section 65302.9, local agencies in the Sacramento–San Joaquin Valley are required to amend their general plans within 24 months of the Board's adoption of the CVFPP, to contain the following:

> *(1) The data and analysis contained in the Central Valley Flood Protection Plan, including, but not limited to, the locations of the facilities of the State Plan of Flood Control, the locations of other flood management facilities, the locations of the real property protected by those facilities, and the locations of flood hazard zones.*
>
> *(2) Goals, policies, and objectives, based on the data and analysis identified pursuant to paragraph (1), for the protection of lives and property that will reduce the risk of flood damage.*
>
> *(3) Feasible implementation measures designed to carry out the goals, policies, and objectives established pursuant to paragraph (2).*

Second, under CGC Section 65860.1, those cities and counties are also obligated to amend their zoning ordinances to be consistent with these required amendments to their general plans within 36 months of the adoption of the CVFPP.

Third, following these general plan and zoning ordinance amendments, under CGC Sections 65865.5, 65962, and 66474.5, local agencies must make at least one of the following findings before granting entitlements to develop and approving certain building permits:

> *(1) The facilities of the State Plan of Flood Control or other flood management facilities protect the property to the urban level of flood protection in urban and urbanizing areas or the national Federal Emergency Management Agency standard of flood protection in nonurbanized areas.*
>
> *(2) The city or county has imposed conditions on the development agreement that will protect the property to the urban level of flood protection in urban and urbanizing areas or the national Federal Emergency Management Agency standard of flood protection in nonurbanized areas.*

> *(3) The local flood management agency has made adequate progress on the construction of a flood protection system that will result in flood protection equal to or greater than the urban level of flood protection in urban or urbanizing areas or the national Federal Emergency Management Agency standard of flood protection in nonurbanized areas for property located within a flood hazard zone, intended to be protected by the system. For urban and urbanizing areas protected by project levees, the urban level of flood protection shall be achieved by 2025.*

The statutory requirements combined could establish substantial restrictions on development in floodplains in the SPA. Enforcement of these requirements will be triggered by adoption of the CVFPP, the adoption of which is, itself, required by law to occur by July 1, 2012 pursuant to CWC Section 9612(b).

The actions of the California Legislature do not fall under the jurisdiction of CEQA and the Legislature has exempted projects that are ministerial in nature through section 21080(b) of the California Public Resources Code. The local planning obligations described above were established by an act of the Legislature and their triggered implementation is mandatory; when the CVFPP has been adopted as required by state law, the local planning and findings requirements will automatically become applicable. Thus, in many ways the effects of these land use requirements are not subject to review under CEQA. However, to serve the informational and public participation purposes of CEQA, DWR has included in this PEIR a description of the potential environmental consequences of all direct and indirect effects of adoption of the CVFPP, including the indirect environmental effects of those local land-use planning approval actions that were adopted by the Legislature in the 2007 flood legislation.

2.3.9 Regional Planning

The USACE Central Valley Integrated Flood Management Study (CVIFMS) is a feasibility study to evaluate flood management improvements in the Central Valley from a federal perspective, and to provide a framework for authorizing and implementing flood risk reduction projects in the Central Valley. When completed, this feasibility study will ultimately be used to determine the federal interest in implementing elements of the CVFPP and identifying nonfederal responsibilities regarding changes to the SPFC. The CVIFMS would integrate information and findings from the two State basinwide feasibility studies. The State-led feasibility studies will integrate information presented in regional flood management plans prepared by local agencies, and information, analyses,

and evaluations conducted as part of federal feasibility studies and the CVIFMS.

Development of regional flood management plans and formulation of specific capital improvement projects will continue after completion of the 2012 CVFPP. This plan development process will coordinate with other overlapping planning efforts by identifying common goals and pursuing opportunities to collaborate and reduce potential conflicts with these other efforts. The information gathered for the regional flood management plans will be used to help develop of the State basinwide feasibility studies scheduled for completion by 2017.

2.3.10 Early Implementation Projects and Other Accomplishments of the Past 5 Years

Development of the CVFPP began in January 2007 when substantial bond funding became available. Since that time, DWR has invested in prudent Central Valley flood risk reduction projects and programs in advance of the CVFPP, pursuant to CWC Section 9613, which authorizes certain flood improvement measures before the adoption of the CVFPP. For example, improvements in maintenance, emergency response, and repair of critically eroding levees, floodplain delineation, levee investigations, and upgraded levees for urban areas were important investments, integral to the SSIA, that could be made while the CVFPP was being prepared. The strategy for investing in projects that are ready to move forward, are feasible, and are considered to be consistent with the CVFPP goals will continue during the next 5 years while detailed, basinwide feasibility studies are completed. Implementation is based on phasing—prioritizing funding for the most critical actions, while setting the foundation for flood system improvement and developing more detailed feasibility studies to support the SSIA.

During the 5-year period of 2007–2012, approximately $1.6 billion was invested by the State in these early activities. Major accomplishments to date are summarized beginning on page 4-27 of the December 2011 Public Draft CVFPP. For example, managing agencies including DWR have repaired more than 120 critical levee erosion sites, proactively repaired more than 220 additional levee sites, removed 3 million cubic yards of sediment from bypasses, and rehabilitated seven flood system structures. Agencies have also commenced major improvements including the American River Common Features Project, Folsom Dam Modifications, Natomas Basin improvements and major setback levee and other projects undertaken by the Three Rivers Levee Improvement Authority.

Adding to these previous efforts, $1.5 to $1.7 billion of bond funding is authorized and available for implementing flood risk reduction projects associated with the SPFC during the upcoming 5 years. Under the currently

available funding, therefore, investments during the next 5 years will generally be commensurate with those made during the previous 5 years. Those previous investments, and the construction and other activities that they supported, compose part of the environmental baseline. However, this PEIR takes a conservative approach and generally assumes that those management activities undertaken in the future will reflect new initiatives, rather than a continuation of recent levels of effort.

2.4 Proposed Management Activities

Management actions are building blocks that can be combined in different ways to form systemwide solutions that collectively address the objectives of the proposed program.

The management actions evaluated in this PEIR consist of one or more individual activities that fall into two categories:

- **Near-term management activities (NTMAs)** are the management activities (i.e., portions of management actions)—conveyance, storage, and other activities—that are likely to occur during the first 5 years after adoption of the CVFPP. These NTMAs generally correspond to the Near-Term Priority Actions described in the Public Draft CVFPP beginning on page 4-30, but also flexibly encompass other activities that may occur during that time frame. It should be noted that not all of the Near-Term Priority Actions described in the CVFPP may be implemented given funding and other practical limitations. NTMAs are highlighted in this PEIR because they address critical or high-priority repairs, reconstruction, and improvements to the flood system and could be implemented with existing funding sources, such as funds remaining from Propositions 1E and 84 (described in Section 1.1.1, "Legislation," in Chapter 1.0). NTMAs are described only for the extended systemwide planning area (Extended SPA) (i.e., the Sacramento and San Joaquin Valley and foothills and the Sacramento–San Joaquin Delta and Suisun Marsh).

- **Long-term management activities (LTMAs)** are the management activities—conveyance, storage, and other activities—that would be implemented beyond 5 years after adoption of the CVFPP. In some cases, LTMAs include the continuation of NTMAs. LTMAs are addressed for the Extended SPA and Sacramento and San Joaquin Valley watersheds. None of the management activities included in the proposed program would be implemented in the SoCal/coastal Central Valley Project/State Water Project (CVP/SWP) service areas.

Individual management activities included in the proposed program are discussed in three categories: conveyance-related activities, storage-related activities, and other activities. The management activities in these categories represent the range of individual strategies that could be used to accomplish the proposed program, as summarized in Chapter 5.0, "Alternatives." As described previously, additional feasibility studies, design activities, and environmental review would be needed before any of the physical elements of the proposed program could be implemented.

2.4.1 Near-Term Conveyance-Related Management Activities

Conveyance-related NTMAs are near-term activities that could improve or restore the overall flood conveyance capacity of the flood system—typically through in-place levee reconstruction, erosion repairs, and/or other facility improvements, or by setting back small sections of levees.

Remedial activities could be implemented on SFPC levees to address adverse geometric conditions (those related to the levee's height, width, slope, or cross section) or other known performance problems that preclude reliable passage of SFPC design flow capacities. In addition, improvement activities could be implemented to achieve an urban level of flood protection in existing urban areas. These potential activities include the following:

- Levees could be raised by adding earthen material or constructing floodwalls to the levee crown. Feasibility would depend on various factors, such as geotechnical conditions; the levee's structural integrity for stability and seepage; and land use and the corresponding level of safety needs on either side of the levee.

- Levees could be strengthened to enhance their structural integrity by improving the properties and geometry of embankment soils to resist slope and seepage failures. To improve resistance to slope failure, levees are enlarged by adding material to widen the levee top, flatten steep slopes, or both. Material can be added to the landside of a levee to increase stability by widening the crown and/or decreasing the side slopes. Material can be added on the waterside in some situations to protect against erosion. Methods to address seepage include constructing seepage berms, stability berms, impermeable barrier curtains (slurry cutoff walls) in the levee and/or its foundation, and relief wells and toe drains. The landside of the levees can be armored to improve the levee's resiliency during overtopping episodes.

- Small levee sections could be set back and/or easements could be purchased where chronic operations and maintenance conditions

complicate continued levee maintenance. Opportunities to restore the quantity, quality, diversity, or connectivity of habitat will also be considered in planning and design of setback levees to accommodate vegetation within the expanded floodway, where feasible.

2.4.2 Near-Term Storage-Related Management Activities

Storage-related NTMAs are near-term activities that could be implemented by changing the flood management operations of existing reservoirs. The F-CO Program seeks to coordinate flood releases from the reservoirs located on various tributaries of a major river. The purpose of the F-CO Program is to optimize use of downstream channel capacity and total available flood storage space in the system, and eventually to reduce overall peak flood flows downstream from these reservoirs. The management process and partnerships formed during F-CO Program development could contribute substantially to enhanced coordination of reservoir operations during flood events. These operational changes could occur through the following mechanisms:

- Objective releases from reservoirs could be increased to reduce the volume of flood storage needed to achieve the same level of flood protection. (Objective releases are the maximum controlled releases during flood operations.) Alternatively, decreasing objective releases could reduce pressure on downstream channels and flood management facilities, but might require a larger flood management reservation.

- Pre-storing a portion of a reservoir's water supply allocation in another facility, such as a groundwater bank, may free additional space in the reservoir for flood management. Similarly, banked water supplies could provide operational flexibility during the flood season and could replace water supplies when reservoirs cannot fill completely after the flood season ends.

2.4.3 Other Near-Term Management Activities

Other NTMAs are near-term activities that do not fall into the categories above, such as implementing the VMS, conservation elements, and policy actions, and purchasing flood easements. These types of activities are described below.

Vegetation Management Strategy

From a flood threat perspective, lower waterside slope vegetation rarely presents an unacceptable threat to levee integrity. However, lower waterside slope vegetation more typically provides beneficial functions, such as slowing nearshore water velocities and holding soil in place to reduce erosion. Dense riparian brush provides the greatest erosion

protection and least levee safety threat. Larger woody vegetation helps stabilize levees through extensive root systems. In consideration of the relatively low potential threat to public safety and high potential impact on State- and federally listed species, the State would do the following, in coordination with the State and federal resource agencies:

- Allow retention of vegetation on the lower waterside levee slope (below the vegetation management zone)

- Protect existing lower waterside levee slope vegetation on State-maintained levees, and encourage a similar practice for projects and maintenance activities by local entities

- Allow development of appropriate vegetation on the lower waterside levee slope and near the waterside levee toe

Vegetation management would generally be limited to a "vegetation management zone" consisting of the landside levee slope and a 15-foot strip adjacent to the landside levee toe, the levee crown, and the waterside levee slope in a zone extending 20 feet below the levee crown. The vegetation management zone is graphically portrayed in Figures 2-1 and 2-2. In most reaches, vegetation would remain unaffected on those portions of the levee immediately adjacent to the river.

For the systemwide scale of the proposed program, it is not practical to assess each levee segment individually to determine relative risk factors and to prioritize integrated system improvements. An expectation of "site-by-site" or "tree-by-tree" assessments would create an unreasonable administrative burden for project proponents and agency staff of all project partners. However, through routine inspections, levees would be inspected multiple times each year for a wide variety of potential problems, including trees that may pose an unacceptable threat to levee integrity, or which create a visibility problem within the vegetation management zone.

This approach affords levee-maintaining agencies with flexibility and encourages them to retain existing trees and other woody vegetation. Because of the importance of these critical vegetation resources, it is anticipated that implementing this vegetation approach would result in retaining, in the near term, the vast majority of existing trees and other woody vegetation that provide important and critical habitat. In the long term, it is anticipated that the vast majority of trees and other woody vegetation on the lower waterside levee slope would be left to continue to grow with little or no management.

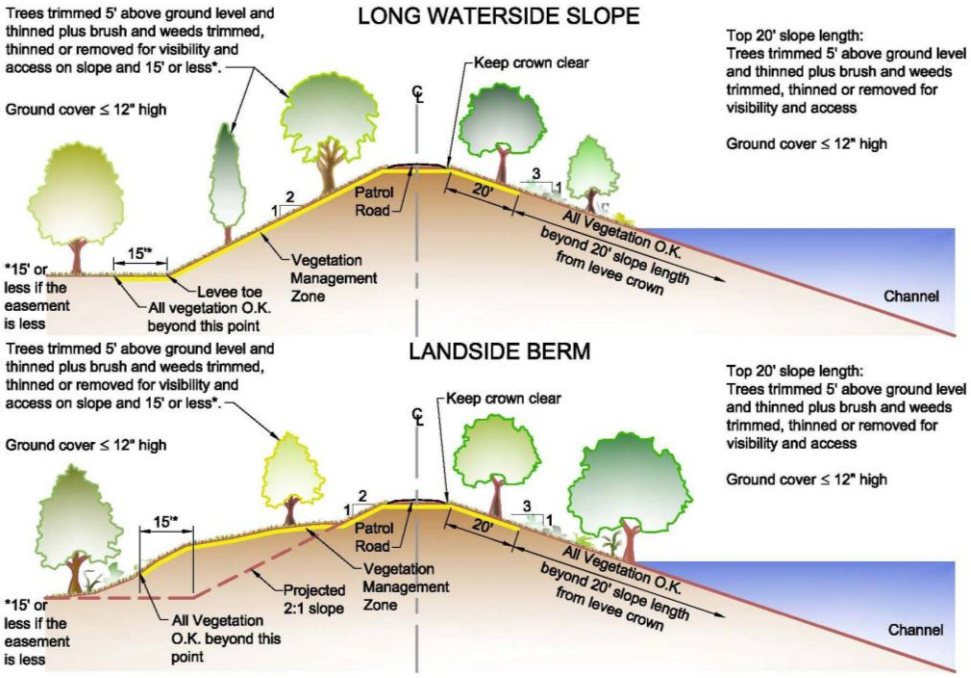

Figure 2-1. DWR Vegetation Inspection Criteria for Standard Levees—Long Waterside Slope and Landside Berm

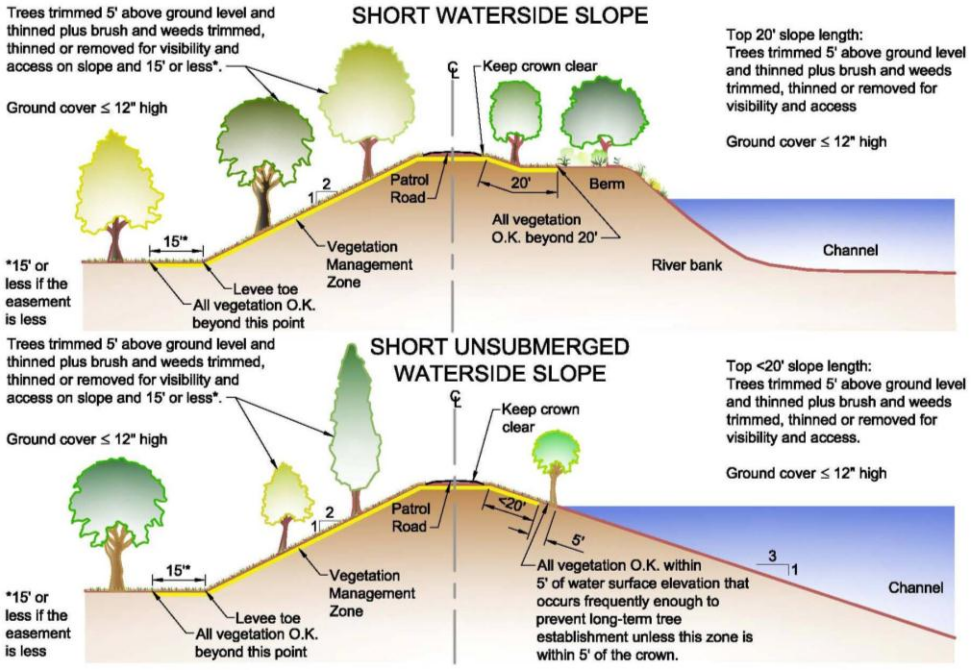

Figure 2-2. DWR Vegetation Inspection Criteria for Standard Levees—Short Waterside Slope and Short Unsubmerged Waterside Slope

A chronology of past and ongoing interaction with USACE regarding implementation of USACE levee vegetation policy and Public Law 84-99 rehabilitation eligibility is provided in Chapter 3.0, "Environmental Setting, Impacts, and Mitigation Measures"; a summary of the proposed program's levee VMS is described below, and the full text of the VMS is included in Appendix E, "Central Valley Flood Protection Plan Conservation Framework." Specific vegetation management procedures would be dependent on whether a levee is (1) a new or legacy levee, and (2) directly adjacent to the river or set back from the channel. Revisions to the following procedures may be considered in future 5-year updates to the CVFPP. The following summarizes the VMS:

- The State proposes adherence to USACE guidance for new levee construction, which typically would be new setback, bypass, or ring levees located away from the river channel.

- Vegetation present on the system, except for the lower waterside slope (those waterside portions of the levee more than 20 feet below the levee crown), would continue to be trimmed to provide for visibility and access, as originally defined in the Framework Agreement, signed in February 2009 by participants of the California Levees Roundtable (2009). It is important to note that vegetation that was introduced, allowed, required as mitigation, or endorsed by a previous USACE action as necessary to comply with environmental requirements, and/or was present when the levee system was transferred from USACE to a nonfederal sponsor, would not be removed. The exception to this would be if changed conditions cause such vegetation to pose an unacceptable threat within the vegetation management zone.

- Vegetation present on the system would be evaluated, based on accepted engineering practice, and as part of the routine operations and maintenance responsibilities of DWR and other levee-maintaining agencies, trees and other woody vegetation would be monitored to identify changed conditions that could pose an unacceptable threat. DWR would develop and incorporate vegetation criteria into its inspection checklist to guide identification of potential threats, as the science becomes available. Any vegetation that has been evaluated and found to present an unacceptable threat would be removed in coordination with the resource agencies.

- DWR would implement, and would advise local maintainers on their implementation of, an adaptive vegetation management strategy. This VMS would include a long-term vegetation life-cycle management plan, which would allow existing trees and other woody vegetation of a certain size to live out their normal life cycles, but would result in the

gradual elimination of trees and other woody vegetation from the vegetation management zone though the removal of immature (less than 4 inches) trees and immature woody vegetation. Throughout their lives and after their deaths, these trees and other woody vegetation within the vegetation management zone would be periodically evaluated; if found to pose an unacceptable threat to levee integrity, they would be removed in coordination with the resource agencies. Vegetation on the waterside of the levee below the vegetation management zone would not be subject to this LCM protocol, and generally would be left unaffected and continue to provide habitat values unless found to pose an unacceptable safety risk.

- Unless mitigated, implementation of the LCM plan would result in the gradual loss of important terrestrial and upper waterside riparian habitat throughout the State-federal project levee system. However, the VMS includes the early establishment of riparian forest corridors that would result in a net gain of this habitat. The CVFPP Conservation Framework includes a tree planting program, which will be more fully defined in the Conservation Strategy, to ensure that the quantity and quality of the riparian corridors of the Central Valley are maintained and enhanced over time. Under the plan, floodways would be expanded and extended to improve the flow carrying capacity of the channels, and the lands acquired for the expansion would be used for habitat restoration and environmentally friendly agricultural activities. The plan includes an estimate that approximately 10,000 acres of new habitats could be created in this way within the flood management system. This estimate could vary based on many factors including land availability and affordability, and available funding; however, the estimate is considered the best reasonably available forecast for purposes of the analysis in this PEIR. In addition to these new habitats, riparian forest planting may also be feasible in many areas on the landside of current levees, in close proximity to the vegetation management zone. For example, where land is acquired for landside seepage berms (which typically extend from 80 to 300 feet from the landside toe), consideration may be given to including trees contributing to this habitat. The riparian forest component of the Conservation Strategy will be further developed in coordination with the applicable resource agencies and in compliance with all applicable permitting requirements. The Conservation Strategy will propose monitoring changes that occur in the riparian forest.

- The proposed program also calls for encouraging and supporting research on the risks and benefits of trees on levee performance, and techniques for concurrently achieving flood risk reduction and environmental quality goals. Research sponsored by State and local

agencies and by USACE is addressing information gaps surrounding levee performance through applied research and an ongoing synthesis of historical information. Findings of these research programs are informing current policy development, and will continue to do so for future CVFPP updates. In addition, further research will follow up on recent research into the effects of woody vegetation on levees, and address other data gaps. DWR and its partnering agencies would incorporate new information into evolving policies and practices.

Long-Term Compatibility of State Vegetation Management Strategy and USACE Vegetation Policy As described in the foregoing, removing lower waterside levee slope vegetation is a very low priority and would generally not be justified until high levee risk factors (as documented in the *Flood Control System Status Report* (DWR 2011)) are addressed. However, compatibility between the State levee VMS and USACE vegetation policy is potentially achievable when framed in the following context:

> *Through long-term implementation of life-cycle vegetation management on the landside slope and upper waterside slope of SPFC levees, the CVFPP levee vegetation management strategy will gradually (over a period of decades) result in levees clear of woody vegetation, consistent with USACE vegetation policy, except for lower waterside vegetation—which is mostly the same part of the levee where USACE has indicated that variances can be appropriate.*

DWR believes that the best path toward State-USACE vegetation policy compatibility is through a sufficiently flexible systemwide variance process consistent with the above levee vegetation management strategy that can supplement, if necessary, the existing vegetation variance for lower waterside slope vegetation (per USACE letter dated August 3, 1949). Removal of woody vegetation on the lower waterside that does not pose an unacceptable threat to levee integrity will be deferred indefinitely to allow for development of new information, tools, and techniques that can expand future options for mutually acceptable treatment of lower waterside vegetation.

Conservation Elements

As stated previously in Section 2.3, "Characteristics and Key Components of the Proposed Program," conservation elements are key components to meeting the objectives of the proposed program. The intent of integrating environmental conservation elements into the proposed program is to enhance habitat and restore natural ecosystem processes and functions, and reduce or avoid requirements for mitigation. Implementing conservation elements could mitigate the adverse impacts of such actions on the

ecosystem, and could restore and enhance the natural hydrologic and geomorphic processes of the Sacramento and San Joaquin Valley riverine systems. These elements have been developed to increase the quantity, quality, diversity, and connectivity of riparian, wetland, floodplain, emergent, and shaded riverine aquatic habitats. Implementing conservation elements could contribute toward the stability and recovery of native species and diversity of the biotic community. Conservation elements have been integrated into many NTMAs to improve the sustainability of the flood management system and the ecosystem benefits that it provides.

Policy Activities and Flood Management Programs

The proposed NTMAs include general policy activities and flood management programs.

General Policy Activities DWR would implement the following policy activities in coordination with local and federal partnering agencies:

- Although noncompliance with USACE vegetation policy may result in Public Law 84-99 ineligibility, the State interest is to follow the VMS presented in Section 2.4.3.

- The State would encourage the resource and trustee agencies to develop a streamlined environmental permitting process to facilitate the necessary permitting for maintenance work and restoration and enhancement actions. Through coordination, collaboration, and cooperative working relationships with all stakeholders and interested parties, such actions would preserve design flows and levee integrity while enhancing environmental resources. Streamlined permitting would foster opportunities to improve the efficiency of the environmental clearance and permitting processes. The actions would still meet State and federal safety standards and follow State and federal environmental compliance procedures.

Flood Management Programs DWR would develop flood management programs in coordination with local and federal partnering agencies:

Flood Emergency Response Program The responsibility of the Flood Emergency Response Program is to prepare for floods, effectively respond to flood events, and quickly recover when flooding occurs. The proposed program would support enhanced emergency response, particularly for rural-agricultural areas where physical improvements are not anticipated to be as extensive as in more populated areas. Program enhancements include providing flood hazard information, real-time flood data, more frequent and timely flood forecasts, and state-of-the-art flood emergency information dissemination. In addition, the SSIA includes a State cost-shared program

for improving levee crowns to provide all-weather access roads that allow agencies to quickly respond to flood emergencies. This is a one-time State-local cost-shared program. The program also provides real-time flood information to assist local agencies in deciding whether and how to conduct flood emergency response and evacuation actions for the public. Priority actions for this program include the following:

- Develop improved flood forecasting and notifications for rural-agricultural areas of the Central Valley, and provide assistance to local agencies in preparing for and responding to flood emergencies.

- Invest in additional monitoring gages and forecasting points to facilitate timely and accurate dissemination of flood information, particularly for rural-agricultural areas subject to more frequent flooding.

- To the extent funding is available, propose a State grant program to assist rural local agencies throughout the Central Valley preparing flood emergency response plans for their jurisdictions, and to develop appropriate regional communication tools and processes for flood emergency response operations.

- Continue implementation of F-CO of reservoirs and initiate F-BO programs, where feasible.

- Provide flood system information to local flood emergency responders.

- Formalize procedures for enhanced inspection and maintenance.

Flood System Operations and Maintenance Program Operations and maintenance responsibilities within the flood management system are fragmented and often confusing. Funding has been insufficient to keep pace with the rising cost of routine maintenance. Implementation of the proposed program will promote efficient and sustainable long-term operations and maintenance practices by doing the following:

- Reforming roles and responsibilities

- Formalizing criteria by which maintenance practices, procedures, and inspections are performed and reported

- Implementing strategies to adequately and reliably fund routine activities and streamline permitting

Some of the proposed activities would likely involve legislative action, new institutional arrangements with local levee maintenance agencies,

modifications to existing State programs, and additional revenue generation.

Priority actions for the Flood System Operations and Maintenance Program are as follows:

- Work with rural-agricultural communities to develop levee repair standards.
- Repair erosion sites throughout the flood system that were identified by the 2011 inspection program, before these sites further degrade the integrity of the flood control system and require costly repair.
- Repair known and documented critical problems, prioritized based on flood risks.
- Provide all-weather access roads on levee crowns for quick response to flood emergencies.
- Implement rural levee projects that are consistent with the SSIA, are ready to proceed, and are shown to be feasible.

Floodplain Risk Management Program The Floodplain Risk Management Program strives to reduce the consequences of riverine flooding in the Central Valley. The State promotes an enhanced floodplain management program, especially in rural-agricultural areas through the following measures:

- The State would actively engage FEMA to help provide grants to local agencies and citizens for applicable risk mitigation actions including property acquisition, structure demolition, and relocation, and for floodproofing and elevating residential and nonresidential structures.
- SB 5, and related legislation passed in 2007, established various floodplain management requirements for cities and counties related to local land use planning. The State will collaborate with local planning agencies and provide information used to develop the CVFPP to help them integrate these data into their local land use planning. The State will also encourage local planning agencies to actively participate in development of regional flood management plans, which will help to reduce flood risk for local jurisdictions and comply with the provisions of SB 5.
- The State supports efforts to reform the National Flood Insurance Program that would result in more equitable implementation while

reflecting corresponding flood risks. Nationally supported flood insurance premiums and payouts should be commensurate with demonstrated flood risk for a structure or area to encourage sound floodplain management at the State, local, and personal levels. Structures that sustain flood losses outside FEMA Special Flood Hazard Areas should be evaluated and their flood insurance premiums adjusted based on their full risk of flooding. In addition, to sustain agricultural communities and support the natural and beneficial functions of floodplains, FEMA should consider establishing a flood zone for agriculturally based communities to allow replacement or reinvestment development in the floodplain for existing structures. The State will work with FEMA to consider a special, lower rate structure that reflects actual flood risks for agricultural buildings in rural-agricultural areas located in Special Flood Hazard Areas.

Priority actions for this program are the following:

- Prepare new flood hazard identification and notification information for rural-agricultural community planners and local officials using updated hydrology and hydraulic studies.

- Work with FEMA to actively engage the agency in floodplain management in the Central Valley, including funding for floodproofing homes and structures in floodplains, relocating structures and homes from deep floodplains, and developing a special insurance program for structures located in floodplains that play a major role in promoting the vibrant agricultural economy in rural areas of the Central Valley.

Flood System Assessment, Engineering, Feasibility, and Permitting Program Risk assessments and engineering are performed under this program that support ongoing planning, feasibility evaluations, and refinement of the SSIA. The program looks beyond individual projects to plan the manner in which all flood management facilities, operations, habitat and ecosystem restoration, and other practices work together as a system to protect life and property and enhance the ecosystem. The program will support development of site-specific improvements. Feasibility studies and updates to the CVFPP will be prepared under this program. This program will also perform flood system engineering and modeling assessments of existing facility conditions for use in identifying areas needing improvements. In addition, the program will develop and maintain hydrologic, hydraulic, geotechnical, economic, and other models and relationships, providing the foundation of information necessary for developing site-specific and systemwide projects. In support of the CVFPP, this program will prepare two basinwide feasibility studies, in partnership with USACE. Priority actions for this program are as follows:

- Launch a major effort to coordinate FloodSAFE activities with all levels of USACE, and with Congress to refine USACE feasibility study processes under the two State basinwide feasibility studies, for the purpose of facilitating timely federal cost-sharing of flood management projects in the Central Valley.

- Perform two basinwide feasibility studies: one for the Sacramento River Basin and one for the San Joaquin River Basin.

- Initiate feasibility studies and designs for ecosystem projects that are consistent with the SSIA, are ready to proceed, and are shown to be feasible.

- Complete the Conservation Strategy.

- Develop a comprehensive fine-scale GIS data set of riparian vegetation for the Central Valley.

- On completion of the State basinwide feasibility studies and refinement of the projects, prepare a long-term implementation plan for presentation in the 2017 CVFPP.

- Complete the Financing Plan for the CVFPP in 2013.

- Prepare the 2017 update of the CVFPP, identifying flood management improvements to be made in the subsequent 5-year cycle.

- Continue engagement with partners and stakeholders.

- Evaluate the feasibility of initiating a program to provide postflood recovery assistance to rural-agricultural areas.

- Develop a regional assessment for Regional Advance Mitigation Planning (RAMP)

- Provide programmatic permitting for operations and maintenance of the flood management system.

Flood Risk Reduction Projects Program The Flood Risk Reduction Projects Program conducts the work necessary to develop on-the-ground projects (improving existing facilities and implementing new projects) that are compatible with and support the proposed program's objectives. In addition to improvement of existing facilities and implementation of new projects, some existing flood protection facilities may be removed or modified if they no longer support system performance. The State may

invest in system improvements directly, by investing in new or improved facilities, or indirectly, through grant programs. System improvements would generally be implemented through a partnership of DWR, local agencies, the Board, and USACE, as the interests of agencies in the improvements are identified. Priority actions for this program are as follows:

- Continue to design and construct projects that are consistent with the proposed program, are ready to proceed, and are shown to be feasible, such as levee improvements for high-risk urban and urbanizing areas.

- Implement small community projects that are consistent with the proposed program, are ready to proceed, and are shown to be feasible.

- Acquire lands, rights-of-way, and easements to implement systemwide projects, including extending and expanding the bypass system and ecosystem restoration components, as soon as studies to further refine the locations of the lands to be acquired are completed.

- Work with local agencies to implement rural-agricultural area flood management activities that are consistent with the proposed program, ready to proceed, and are shown to be feasible.

- Work with local agencies and USACE in completing regional flood management plans with USACE to prepare basinwide feasibility studies.

- Complete early FloodSAFE implementation projects needed to begin coordinated operations of reservoirs.

Local Land Use Planning and Other Actions

Following adoption of the CVFPP, all cities and counties in the Sacramento–San Joaquin Valley are anticipated to make corresponding revisions to local general plans and zoning ordinances as described in Section 2.3.8, "Local Planning Obligations," above. Following those revisions, these local agencies would be required to make findings related to an urban level of flood protection (protection from a flood event with a 0.5-percent chance of occurrence) before entering into a development agreement for a property, approving a discretionary permit or entitlement for any property development or use, or approving a ministerial permit that would result in the construction of a new residence, or approving a tentative map/parcel map for a subdivision (see CGC Sections 65865.5, 65962, and 66474.5). Given the statutory timetable for these actions, they are anticipated to occur within the 5-year NTMA period.

2.4.4 Long-Term Conveyance-Related Management Activities

Conveyance-related LTMAs include all conveyance-related NTMAs mentioned above in Section 2.4.1, "Near-Term Conveyance-Related Management Activities," that would continue after the first 5 years after adoption of the CVFPP. They also involve improving the overall conveyance of the flood system through a combination of widening floodways, modifying existing weirs and bypasses, and constructing new weirs and bypasses.

Floodway Widening

Floodways could be widened primarily in locations where persistent erosion or encroachments make maintaining the flood system in its current location unsustainable, and/or to accommodate restoring native vegetation and ecosystem function, where feasible. To widen floodways, easements would be purchased, setback levees would be constructed, or levees would be removed.

Levees could be set back from the main river channel. Setting levees back can enhance the performance of the flood system by reducing peak velocities and stage, provide opportunities to restore habitat, and reduce levee erosion in the long term. Various factors must be considered to determine the suitability of a setback levee: existing flood easements; the ability to acquire needed real estate; the site's geology and topography; existing transportation features and infrastructure; hydraulic effects; opportunities for enhancement of habitat, recreation, and agriculture; and the potential for erosion reduction. Levee setbacks can be sited in areas where levees are identified as deficient, thereby reducing long-term operations and maintenance and associated costs.

Weirs and Bypasses

Existing weirs, bypass systems, and appurtenant SPFC facilities could be modified to achieve a variety of benefits, such as increased conveyance capacity, reduced stages and peak flows, and restored ecosystem processes, where determined feasible. New bypasses or weirs might also be constructed. Specific improvements to, modifications of, and/or construction of new weirs and bypasses being considered in the CVFPP are identified in Chapter 3 of the December 2011 Public Draft of the plan. Flood conveyance capacity could be increased by modifying existing weirs and bypasses as described below.

Weirs could be modified in any of several ways, depending on their configuration, operation, and desired effect: by raising, lowering, lengthening, or automating the weir or by changing the weir sill elevation. For example, a weir crest could be raised to prevent flows from entering a

storage area too early in a flood event, thereby reserving storage space for the peak of the storm. As an alternative, weirs could be lengthened to pass more flow into a bypass at the same stage, or lowered to divert flow at lower stages. Other modifications could include removing sediment or debris to improve the intended performance of a weir. Weir modifications could also be designed to provide opportunities to restore ecosystem functions or habitats, reduce operations and maintenance, and improve safety. For example, improving weirs could allow greater fish passage, change the flow split, manage sediment deposition, or increase the safety of weir operations (floodgates). Depending on timing, duration, and a host of related hydraulic factors, more frequently activated floodplain in the bypasses could potentially provide a more productive rearing habitat for juvenile fish species.

The capacity of existing bypasses could be increased by widening or expanding the footprint of a bypass or, in some locations, by raising its levees or berms. Existing flow control weirs that direct flood flows might need to be reconstructed and/or reoperated in conjunction with bypass modifications. Increasing the capacity of certain bypasses could provide opportunities to enhance habitat, recreation, and agriculture. Integrating conservation measures with bypass modifications might involve removing riprap or other hard points, adding fish passage features such as low-flow channels, and establishing wetland or riparian habitat.

Flood system conveyance capacity could be increased by constructing new bypasses. However, because the existing flood management system already features several large and effective bypass systems, new bypasses would likely be constructed at a smaller scale. New bypasses could be constructed to redirect damaging flood flows away from existing channels or facilities that currently lack sufficient conveyance capacity. Siting for construction of new bypasses needs to consider various factors such as topography; the magnitude of flood flow; potential hydraulic impacts downstream; opportunities to enhance habitat, recreation, and agriculture; and right-of-way requirements. New bypasses could provide opportunities for environmental conservation, similar to those described previously for bypass modification.

Weirs and other control structures could be rehabilitated with hydraulic structure upgrades. This includes rehabilitating weirs and other control structures (removing sediment that has deposited), or even automating existing weirs.

Remedial Activities

Remedial activities could be implemented on SPFC levees to address geometric conditions (those related to the height, width, slope, or cross

section of the levee) or other known performance problems that preclude reliable passage of SPFC design flow capacities. These actions could be implemented in a variety of ways (as described previously for NTMAs), such as reconstructing levees in place or setting levees back to address undesirable foundation conditions.

New Levees

New levees could be constructed along river reaches where no levees are currently present, thereby lowering the risk of flooding on adjacent lands. Constructing levees might not be feasible in all areas because of the presence of existing infrastructure or development, and the associated cost of construction, land acquisition, and long-term maintenance. However, in some areas, no other management activities might be capable of managing flood flows or achieving the desired public safety goals.

Removal of State Plan of Flood Control Facilities

Over the years, some of the facilities included in the SPFC have failed to achieve their original design objectives, deteriorated to the point of becoming nonfunctional, or otherwise become a detriment to the existing system. Accordingly, in some cases it is in the public interest for the State to formally remove these facilities from the SPFC. Removal of a facility from the SPFC may consist of physical and administrative actions, or only administrative actions. Specific facilities being considered for removal from the CVFPP are identified in Chapter 3 of the December 2011 Public Draft of the plan.

2.4.5 Long-Term Storage-Related Management Activities

The storage-related LTMAs include all storage-related NTMAs mentioned above in Section 2.4.2, "Near-Term Storage-Related Management Activities," that would continue after the first 5 years after adoption of the CVFPP. Additional storage-related LTMA is the F-BO Program. The F-BO Program would involve using improved long-term forecasts of runoff and operating within the parameters of an existing flood control diagram. To proactively manage reservoirs by using a more flexible flood control diagram, managers would have to conduct extensive studies of the most feasible diagram, complete environmental documentation for changing reservoir operations, and obtain congressional approval for a new dynamic flood control diagram. These operational changes could occur through the following mechanisms:

- Reservoir rule curves could be modified to specify additional downstream control points and establish coordination with the operations of other reservoirs.

- Weather forecasting provides operators with meteorological information that could be used to anticipate future reservoir inflows. This information would help operators better manage the flood storage allocation for the peak of the storm, and would help minimize the risk of exceeding downstream channel capacity. Improving predictions of potential future flows and reservoir releases could also increase the flood warning times for communities along the rivers downstream from flood management reservoirs. Implementation would include both the F-CO and F-BO programs.

The proposed program includes a commitment not to implement the F-CO Program or F-BO Program in such a way as to reduce water supply or reliability, or renewable electricity (hydropower) production. Instead, it is anticipated that, over time, these programs will increase water supply and reliability, as well as hydropower production.

2.4.6 Other Long-Term Management Activities

Other LTMAs include all other LTMAs mentioned above in Section 2.4.3, "Other Near-Term Management Activities," that would continue after the first 5 years after adoption of the CVFPP, as well as the actions summarized below.

Urban Flood Protection

Urban areas (areas with a population of greater than 10,000) should be protected from a flood event with a 0.5-percent risk of occurrence in any given year by conveyance-related actions. Specific improvements being considered in the CVFPP are identified in Chapter 3 of the December 2011 Public Draft of the plan. Repairs and improvements would typically be implemented within current facility footprints (in-place fixes) because of the proximity of existing development and infrastructure.

In-place fixes could involve the following actions:

- Raising levees by adding earthen material or constructing floodwalls. Various factors would be considered when specific actions are determined, such as the need to perform a geotechnical evaluation of the levee's structural integrity for stability and seepage, and the land uses and corresponding level-of-safety needs on either side of the levee.

- Strengthening levees to enhance their integrity by improving the embankment's soil properties and/or geometry to resist slope and seepage failures.

Urban areas also could be protected by constructing new levees along river reaches where no levees are present. In some cases, small communities may achieve flood protection as part of adjacent urban area improvements.

Small-Community Flood Protection

Many small communities in the SPFC Planning Area are expected to receive increased flood protection through implementation of system elements and improvements focused on adjacent urban areas, although some of these improvements may take many years to implement. The State will evaluate investments to preserve small-community development opportunities without providing an urban level of protection. Additional State investments in small-community protection will be prioritized based on relative community flood threat levels, considering factors such as population, likelihood of flooding, proximity to flooding source, and depth of flooding. Other factors considered in prioritizing small-community flood improvements include financial feasibility and achievement of the CVFPP Goals with respect to integrating multiple benefits.

In general, the State will consider the following structural and nonstructural options for protecting small communities in the SPFC Planning Area from a 100-year (1-percent-annual-chance) flood:

- Protecting small communities "in-place" using ring levees, training levees, or floodwalls when improvements do not exceed a certain predetermined cost threshold. For planning purposes for the SSIA, DWR used a preliminary cost threshold of $100,000 per house protected, an approximate value for elevating or flood proofing a house. When estimated costs exceed the threshold, nonstructural means for flood protection will be considered. DWR will further evaluate this threshold during future studies.

- Reconstructing or making improvements to adjacent SPFC levees.

- Implementing nonstructural improvements, such as raising/elevating structures, flood proofing, land or easement purchases, and/or relocating structures, when the in-place improvements described above are not feasible.

A ring levee is constructed around the protected area, isolating it from potential floodwaters. Internal levees, on the other hand, serve as a second line of defense by isolating portions inside a larger protected area. Both ring and internal levees could be used as secondary lines of defense. Ring levees could also act as the primary line of defense in the absence of other forms of flood management. Ingress to and egress from an area protected by such levees might be difficult if the levee were more than a few feet tall

because long ramps could be required to provide vehicular passage over the top of the levee. Conservation features, such as vegetation buffers, could be integrated with ring levee design.

In areas where flood management systems protect large basins or floodplains, training levees could be used to subdivide the protected basin or floodplain and provide greater protection to small communities, infrastructure, or other features. Training levees are secondary levees that can redirect the erosive forces of floodwaters to reduce the likelihood of levee failure along a river or main flood management channel.

Rural-Agricultural Area Flood Protection

In general, the State would consider the following options to protect rural-agricultural areas against floods, with a focus on integrated projects that achieve multiple benefits:

- Improvements to SPFC levees in rural-agricultural areas would focus on maintaining the levee crown elevation and providing all-weather access roads to facilitate inspection and flood fighting.

- Levee improvements, including setbacks, may be used to resolve known performance problems (such as erosion, boils, slumps/slides, and cracks) on a prioritized basis, where justified. Projects will be evaluated that repair or reconstruct rural SPFC levees to address identified threat factors, particularly in combination with small-community protection, where economically feasible.

- Agricultural conservation easements that preserve agriculture and prevent urban development in current agricultural areas may be purchased, when consistent with local land use plans.

The State, in consultation with local entities, will prioritize available funding among all-weather roads and other important investments, addressing the greatest need first.

Changes to Policies, Guidance, Standards, and Institutional Structures

As part of the LTMAs for the proposed program, various changes would be made to policies, guidance, standards, and institutional structures. The intent of these changes would be to address residual flood risks, improve management of floodplains and the flood system, and support long-term program implementation. These management actions include the following:

- DWR would implement the VMS (as described for NTMAs under "Vegetation Management Strategy" in Section 2.4.3, "Other Near-Term Management Activities").

- The State would support efforts to reform the National Flood Insurance Program that would result in more equitable implementation while reflecting corresponding flood risks. Nationally supported flood insurance premiums and payouts should be commensurate with demonstrated flood risk for a structure or area to encourage sound floodplain management at the State, local, and personal levels. Structures that sustain flood losses outside FEMA Special Flood Hazard Areas should be evaluated and their flood insurance premiums adjusted based on their full risk of flooding. In addition, to sustain agricultural communities and support the natural and beneficial functions of floodplains, FEMA should consider establishing a flood zone for agriculturally based communities to allow replacement or reinvestment development in the floodplain for existing structures. The State will work with FEMA to consider a special, lower rate structure that reflects actual flood risks for agricultural buildings in rural-agricultural areas located in Special Flood Hazard Areas.

- SB 5 required DWR to propose updated requirements to the California Building Standards Code (Building Code) for construction in areas in the SPFC where flood levels are anticipated to exceed 3 feet for the 200-year flood event. A first phase of Building Code amendments related to construction within floodplains has been adopted by the California Building Standards Commission as voluntary measures. Additional proposed amendments are under development by DWR, in coordination with relevant State regulatory agencies and major industrial and professional groups. The focus is on the deep floodplains in the Central Valley with high probability of floodwater ponding. Building Code amendments can call for various structural improvements to protect public safety and for dry and wet floodproofing to reduce the overall consequences of flooding.

Conservation Elements

As described for NTMAs under "Conservation Elements" in Section 2.4.3, "Other Near-Term Management Activities," conservation elements would be integrated into many LTMAs to improve the sustainability of the flood management system and the ecosystem benefits it provides.

Conservation elements of the LTMAs include the following:

- **Bypass expansion**—Bypass expansion could substantially increase the overall area of frequently activated floodplain that would support

riparian, shaded riverine aquatic, and wetland habitats, while also providing a continuous corridor of these habitats. The plan includes an estimate that approximately 10,000 acres of new habitats could be created in this way within the flood management system. This estimate could vary based on many factors including land availability and affordability, and available funding; however, the estimate is considered the best reasonably available forecast for purposes of the analysis in this PEIR.

- **Improvements in urban areas**—Urban flood protection projects should, at a minimum, preserve and restore important shaded riverine aquatic habitat along riverbanks and help restore the regional continuity and connectivity of such habitats.

- **Improvements in rural-agricultural areas**—The State's preference in rural areas is to integrate environmental restoration and conservation with rural-agricultural flood protection projects. In wider floodways, valuable wildlife habitat can be provided by flood-compatible agriculture, such as grains and row crops used as foraging habitat for Swainson's hawks and sandhill cranes. Specific flood-compatible improvements to agriculture being considered by the CVFPP are identified in Chapter 3 of the December 2011 Public Draft of the plan.

- **Fish passage**—This element involves improving fish passage at SPFC weirs, bypasses, and other flood management facilities undergoing modification or rehabilitation to improve access to upstream aquatic habitat and facilitate natural flow routing. This would allow improved access to spawning and rearing habitat, including the remaining cold-water spawning and rearing habitats in the higher elevation watersheds.

- **Biotechnical bank protection—**Biotechnical bank protection is the combined use of plants with other materials to stabilize streambanks and levees. This can increase bank resistance to erosion. Vegetation (e.g., tules) can also attenuate wave energy, which reduces erosive forces. Thus, biotechnical bank protection can complement or reduce the need for revetment. Biotechnical bank protection should be incorporated, where appropriate, during design or repair of facilities. It generally entails planting cuttings and container plants in shallow water adjacent to banks, in exposed soil along banks, or in revetment. If incorporated into revetment, some localized modification of revetment (such as incorporating uncompacted soil) may be necessary.

- **Habitat restoration and modification of SFPC facilities**—Collaborate with others on a variety of activities related to habitat restoration and modification of SPFC facilities:

- **Design setback levees to provide environmental benefits**. To do so, choose locations where removing vegetation would be unnecessary to set back the levee and where dynamic geomorphic channel processes can be incorporated (e.g., channel meander migration and avulsion, and sediment transport); and include permanent structures in the setback area to reduce impacts on floodplain processes.

- **Lower floodway elevations to provide more frequent and sustained inundation of lower floodplain surfaces.** Floodplain inundation and associated habitat values have been reduced where the main river channel has become incised below the floodway, river flows have been reduced, or both. In these areas, lowering floodplain surfaces would allow more frequent and sustained inundation, restoring habitat values. This action would also help increase the capacity of local floodways.

- **Modify floodways** to provide greater topographic and hydrologic diversity, while also eliminating features (such as isolated gravel pits or deep borrow pits) that strand fish. This could involve creating or opening up secondary channels and overflow swales that would provide additional riverine and floodplain habitat values, including resting or rearing areas for fish migrating upstream.

- **Develop advanced mitigation programs** and regional mitigation banks, supported by State and federal policies, partnerships with regulatory agencies, and sustainable funding sources.

- **Incorporate corridor management planning** to improve flood management and ecological conditions at scales that are both manageable and flexible to meet multiple needs.

- **Restore natural river processes** of migration and sediment transport by modifying channels or removing unnecessary facilities.

Floodwaters come from the lands drained by rivers and streams. As recognized by the State's *California Water Plan* (DWR 2009), land use planning has an important role in reducing this runoff. Integrated planning with local land use authorities and major public land managers in watersheds can help reduce the intensity of flooding event, by designating land uses (e.g., native vegetation and agricultural crops) that absorb floodwaters and increase percolation into groundwater reservoirs.

2.5 Implementation of the Proposed Program

Adoption of the proposed program by the Board would not lead directly to construction of improvements or implementation of other elements of the program. Rather, it would guide a variety of follow-on studies and planning efforts, environmental reviews, changes to policies and guidance, and other implementation actions (e.g., development of financing strategies and funding sources), some of which are currently in progress. The State's implementation role in these actions varies, and may include leadership in planning and/or construction, financial assistance, technical support, operation and maintenance, and regulation. Based on the information in the CVFPP and this PEIR, it is expected that DWR and the Board would participate in follow-on feasibility studies; that the Board would act within its existing regulatory, planning, and project implementation capacities; and that State agencies would change policies, guidance, or regulations related to flood management as necessary. Other non-State entities may also participate in implementing the proposed program. For example, modifying the SPFC would require participation by USACE, the Board, and local nonfederal project sponsors.

2.5.1 Implementation in Accordance with Applicable Laws and Regulations

Implementation of the program would be undertaken in compliance with all applicable laws and regulations, and the adoption and approval of the program is conditioned on such compliance. Numerous State and federal laws, regulations, and executive orders would be considered: CEQA, the National Environmental Policy Act, the Fish and Wildlife Coordination Act, the Clean Air and Clean Water acts, the California and federal endangered species acts, the National Historic Preservation Act, the California Public Resources Code, and other applicable laws and regulations.

The specific permits and authorizations that would be required for future projects will vary depending upon the nature and location of the activities involved. Possible permits and authorizations required for future projects with implementation of the CVFPP are summarized in Table 2-2.

Table 2-2. Possible Permits and Authorizations

Resource	Applicable Laws/Regulations/Permits	Regulating Agency
Wetlands and waters of the United States	Section 404 of the Clean Water Act—individual or general permit	USACE
	Section 10 of the Rivers and Harbors Act — individual or general permit	USACE
	Section 401 of the Clean Water Act—water quality certification or waiver	Central Valley RWQCB
	Section 402 of the Clean Water Act—National Pollutant Discharge Elimination System permit(s)	SWRCB and Central Valley RWQCB
	Sections 1600-1607 of the California Fish and Game Code—streambed alteration agreement	DFG
Federally listed species	Section 7 of the federal Endangered Species Act—Section 7 consultation Section 10 of the federal Endangered Species Act—habitat conservation plan	USFWS and NMFS
Essential Fish Habitat	Magnuson-Stevens Act	NMFS
Fish and wildlife resources	Fish and Wildlife Coordination Act report	USFWS
Cultural resources	National Historic Preservation Act—Section 106 consultation	SHPO
State-listed species/State special-status species	Section 2081 of the California Endangered Species Act—incidental take permit/consistency determination Natural Community Conservation Planning Act	DFG
	California Native Plant Protection Act	DFG
Alterations of federal flood protection projects	Encroachment permit (CCR Title 23); Central Valley Flood Protection Board encroachment permit; and CFR Title 33, Sections 208.10 and 408	Board and USACE
	Agreements	Local levee districts
Work within the State Plan of Flood Control that does not affect a federally constructed flood protection project	Encroachment Permit (CCR Title 23); Central Valley Flood Protection Board encroachment permit; and CFR Title 33, Section 208.10	Board
Water rights	California Water Code—water right petitions	SWRCB

Table 2-2. Possible Permits and Authorizations (contd.)

Resource	Applicable Laws/Regulations/Permits	Regulating Agency
State lands	Land use lease	State Lands Commission
Air quality	Authority to Construct, Permit to Operate	Air pollution control districts
Transportation Infrastructure and Utilities	Encroachment permit	Caltrans, various utility companies, railroads, local and county roads, etc.
Surface mining	California Surface Mining and Reclamation Act permit	SMARA lead agencies and California Department of Conservation

Source: Data compiled by MWH in 2011
Key:
Board = Central Valley Flood Protection Board
Caltrans = California Department of Transportation
CCR = California Code of Regulations
Central Valley RWQCB = Central Valley Regional Water Quality Control Board
CFR = Code of Federal Regulations
DFG = California Department of Fish and Game
NMFS = National Marine Fisheries Service
SHPO = State Historic Preservation Officer
SMARA = Surface Mining and Reclamation Act
SWRCB = State Water Resources Control Board
USACE = U.S. Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service

Therefore, this PEIR will not only support decisions by DWR and the Board to adopt the CVFPP, but will also provide information to support subsequent project-level decisions by maintaining agencies (such as DWR and reclamation districts) when undertaking management actions, as well as supporting the decisions of permitting and other authorizing entities. The listing of potential project-level approvals in Table 2-2 is not exclusive, and this PEIR is intended to help support any and all approvals necessary or desirable to carry out activities under the program.

As described in Section 2.3.8, "Local Planning Obligations," above, adoption of the proposed program by the Board also would trigger various requirements established by the California Legislature related to local land use planning and management. These requirements oblige local jurisdictions to consider flood risk and flood management in their planning and decision-making processes (e.g., general plans, zoning ordinances, development agreements, and other actions). Such consideration must occur both concurrently with development and implementation of the proposed program and after its adoption by the Board. Local jurisdictions

may use information or guidance contained in the proposed program to demonstrate that their planning is consistent with State flood protection requirements for urban areas and small communities. They may also use this information to guide development of local or regional flood management projects to be consistent with the proposed program so that the State may participate financially in these projects.

Because of the size and complexity of the proposed program, it is likely to be implemented over a period of 20 years or more. Future updates to the proposed program, including the 2017 CVFPP update, would refine the program; use new data and tools for systemwide analyses; provide updated recommendations for implementation; establish links to follow-on studies and programs, such as detailed feasibility studies; and support continued funding/appropriations for implementation.

In addition, subsequent implementation actions stemming from adoption of the proposed program would involve additional project-level environmental review and documentation to the extent required by CEQA and the CEQA Guidelines.

2.5.2 Financing Strategy for Implementing the Proposed Program

The Central Valley Flood Protection Planning Act of 2007 requires DWR to prepare a financing plan for the proposed program. After adoption of the CVFPP in 2012, DWR would prepare a framework for financing of projects at a regional level. DWR would use the information gathered from preparation of the framework to prepare a financing plan for the CVFPP that would guide investment in flood risk management in the Central Valley during the next 20 years. The financing plan would be available in 2013, after adoption of the 2012 CVFPP. The financing plan would be critical to implementation, given the uncertainty in the budgets and cost-sharing capabilities of State, federal, and local agencies.

A mix of federal, State, and local funds would be needed to implement the proposed program. Funding sources would vary according to the type of project or program, beneficiaries, availability of funds, urgency, and other factors. Cost sharing among State, federal, and local agencies may also change depending on project objectives. A legislative requirement for the proposed program is to maximize, to the extent feasible, federal and local cost sharing in flood management projects. Cost-sharing rules are governed by federal and State laws, regulations, and policies, which continue to evolve over time. The geographic extent and magnitude of project benefits must be evaluated to identify potential beneficiaries on a regional or systemwide scale. The intent of the proposed program is to support equitable distribution of project costs among beneficiaries, encourage

projects that provide benefits outside their immediate locales, and help achieve added flexibility in the SPFC.

Implementation of the proposed program would require an investment of $14 to $17 billion, including amounts already expended since 2007. Through Propositions 84 and 1E, the State has provided approximately $5 billion for flood management activities, of which about $3.3 billion have been allocated for the implementation of proposed program. Of these funds, approximately $1.5 to $1.7 billion remains available for near-term activities. An additional $11 to 14 billion would be needed from federal, State, and local sources during the next 20 years. It is anticipated that another State bond would be required to augment funding from federal and local agencies. How much funding would be available from these sources and when the funds would become available is not known at this time.

2.6 No Near- or Long-Term Reduction in Water or Renewable Electricity Deliveries

As discussed in Section 2.4.2, "Near-Term Storage-Related Management Activities," the proposed program includes changes to the flood management operations of existing reservoirs. Among the potential effects of the proposed program on the study area that could result from changing the flood management operations of existing Central Valley reservoirs are incidental indirect effects of such reservoir reoperations on deliveries of water and/or renewable electricity (hydropower) to those areas. As explained below, these indirect effects would most likely be beneficial because improving reservoir and systemwide operations could actually increase the availability of these resources, particularly over time. Any reductions in the availability of water and renewable electricity are anticipated to be minimal and well within the capacity of the entities receiving these resources to respond to minor supply fluctuations.

The proposed program includes a commitment to no substantial or long-term reductions in water supply reliability or deliveries. The proposed program makes only minor changes to the system's overall water storage capacity and the management of storage and releases through willing partnerships. The proposed program would not involve removing any existing storage facilities. The only new or modified surface-storage facility included in the program is the Folsom Dam Raise, which is already authorized and under construction.

Multipurpose reservoirs are managed to allocate the available storage space above minimum pool between water supply and flood control. Reservoir operations typically are governed by fixed allocations of reservoir capacity

based on the time of the year, without regard to anticipated weather conditions or the amount of available capacity in other reservoirs in the watershed.

The reservoir reoperations component of the proposed program would modify these current management practices to integrate information from weather forecasts (F-BO) and coordinate the operations of multiple reservoirs in a more flexible, adaptive fashion. This could, for example, result in the increased drawdown of a reservoir in anticipation of near-term storm events in the watershed that have high runoff potential (temporarily increasing the flood allocation to create space for the expected runoff). Conversely, when relatively dry conditions can reliably be predicted, the flood allocation could be reduced (increasing the water supply allocation). Under this more adaptive and flexible approach, water supplies and related hydropower generation could increase relative to existing management protocols.

Occasionally, however, a forecasted period of wet weather might not materialize. As a result, reservoirs might be drawn down to provide additional storage capacity for flood flows without being refilled by the expected runoff. In these circumstances, a temporary reduction in water supply from the reservoir (and related hydropower generation) could occur. In those circumstances where a substantial overprediction of runoff coincides with dry-year conditions, the water supply could be reduced for the remainder of the season, which could also reduce the carryover supply for future years.

DWR has modeled the possible performance of the proposed reoperations protocols under a range of scenarios, concluding that over time, the beneficial effects of the correct forecasts would outweigh the supply-reducing effects of incorrect forecasts. However, these models also show that a minor reduction in water supply could occur under certain critical dry-year scenarios.

Both the NTMAs and LTMAs include F-BO, in which more accurate long-term runoff forecasting would be used to provide greater flexibility in the reservoir operations criteria. As described above, under existing conditions, floodwater must be released once the reservoir reaches a specific level between specific dates. Proposed changes to this method include allowing releases to occur at a range of water levels rather than at a single set water surface elevation, based on long-term forecast data. Under this scenario, less water may be released during some months to enhance flood protection, and more may be released during other months to support water deliveries. Relatively minor changes to the timing and volume of releases may occur; however, the overall volume of water stored and releases

available for water supply and hydropower generation may be materially reduced only during some critical dry years, when water releases to increase storage capacity were made without a similar amount of storm-generated runoff entering the reservoir.

The water and electric utilities that receive these resources are well adapted to responding to these minor supply fluctuations. The worst-case supply reductions that could result from reservoir reoperations under the proposed program are orders of magnitude less than other supply uncertainties faced by these entities, and well within the scope of the contingency planning undertaken by these entities.

Additionally, any potential program-induced reductions in water deliveries during critical dry years would be compensated for through increased use of other water storage and banking options. During wet years, the proposed program would make additional water available for water bank deposits (i.e., increased allocations of water to groundwater storage). The increased volume of available banked water relative to existing conditions would be tapped during extreme dry years to ensure that deliveries to the Extended SPA would not be materially reduced.

In summary, the proposed program includes a commitment to no long-term reduction in water deliveries to the Extended SPA or the SoCal/Coastal CVP/SWP service areas, and the actions included in the proposed program support this commitment. Therefore, no potential exists for a significant impact on water supply deliveries or hydroelectric power production, and no further analysis is required.

2.7 Typical Construction Activities and Methods

Most conveyance-related and many of the other NTMAs and LTMAs would involve construction activities. These construction activities in turn would result in most of the environmental impacts evaluated in this PEIR. The construction activities would be specific to each type of activity, the location of the activity, and numerous other variables related to the unique characteristics of a project. The magnitude and characteristics of construction activities vary widely, but construction activities for flood protection facilities share many common features. For that reason, to help support the environmental analysis in Chapter 3.0 of this PEIR, this program description includes the following generic discussion of construction activities that can be anticipated to take place during implementation of the proposed program.

Numerous flood protection projects that have included actions similar to the NTMAs and LTMAs analyzed in this PEIR have been implemented in recent years. Among these projects are DWR's levee maintenance programs; the Sacramento Area Flood Control Agency's Natomas Levee Improvement Program; the Three Rivers Levee Improvement Authority's Feather, Yuba, and Bear River levee repair and setback levee projects; and Yuba County Water Agency's Yuba-Feather Supplemental Flood Control Project. The construction activities of these projects have been evaluated and the common features are described below to provide a general program-level description of typical construction activities and methods.

2.7.1 Construction Materials

Soil used to construct, replace, and repair earthen flood protection facilities (e.g., levees, earthen dams) is generally either purchased from commercial sources or excavated from borrow sites. Borrow sites are typically developed for large-scale projects. Before borrow sites are designated, the soil is sampled to ensure that it meets the standards of quality for construction of the proposed facilities, and to identify whether hazardous residues are present (e.g., from agricultural practices) that may need management or removal during borrow operations.

The volume of soil borrow needed for earthen facilities can range from a few hundred cubic yards for minor levee repairs to millions of cubic yards for projects involving miles of levee widening, setbacks, or relocation. Soil borrow available at commercial sites can often be located numerous miles from the construction site, whereas borrow sites developed specifically for a project can often be located near or adjacent to a construction site.

Flood protection projects may also need a source of rock or aggregate material for erosion repair, drainage layers under seepage berms, and temporary access roads used for construction or permanent access roads used for operations and maintenance. Cement and/or bentonite may be used to construct seepage cutoff walls installed as part of levee improvement projects. Concrete, brick, masonry, steel, and similar materials are typically used for structures associated with flood protection projects (e.g., pump buildings). These are typically obtained from commercial sources and require transportation.

2.7.2 Equipment Types

Depending on the type and size of the flood protection project, the following are some of the types of equipment that may be used:

- Excavators

- Scrapers
- Bulldozers
- Graders
- Crawlers/tractors
- Chippers/grinders (to process woody vegetation removed during site preparation)
- Sheepsfoot or tramping-foot rollers (for soil compaction)
- Roller compactors
- Smooth drum compactors
- Water trucks
- Haul trucks (typically off-highway vehicles)
- Highway dump trucks
- Concrete trucks
- Front-end loaders
- Truck-mounted cranes
- Lubricating and fueling trucks (supporting operation of construction equipment)
- Integrated tool carriers (supporting operation of construction equipment)
- Pickup trucks
- Generators
- Slurry pumps
- Backhoes
- Asphalt pavers
- Truck-mounted augers

- Hydroseeding trucks
- Pile drivers

A minor repair project, such as a small erosion repair project, will use only a small number of a few types of equipment listed above. A major improvement project with an expedited schedule, such as the Sacramento Area Flood Control Agency's Natomas Levee Improvement Program, will use a dozen or more of many of these types of equipment.

Waterside construction projects, such as erosion repairs, may use barges to transport construction materials (rock or earthen fill) from borrow or quarry sites because access is easier from a barge on the waterside than from trucks on the landside. These barges may have a built-in crane for moving materials from the barge to the bank. Barges may also be used to transport workers and equipment to waterside project sites and to support special equipment needed for waterside projects, such as hydraulic hammers for installing in-water sheet piles.

2.7.3 Construction Timing

The time to construct flood protection improvement projects can be as short as a few days in the case of minor repairs or as long as several years for major upgrades. Major construction activities are typically concentrated during the dry season (May through October), with some mobilization occurring as early as April. Construction usually occurs only during daylight hours; however, some activities, expedited projects, emergency repairs, and projects nearing the flood season may require continuous daytime and nighttime work. Examples of such activities include some slurry cutoff wall installations and emergency levee repairs.

Depending on weather and river conditions, construction can extend well into November. If a construction phase will extend into the following year's construction season, the site is secured and "winterized" before the start of the flood season (typically November 1).

Various factors and regulations may influence construction timing. For example, work in floodways may be permitted only during the nonflood season; work windows may be limited to the "dry season" as part of streambed alteration agreements with the California Department of Fish and Game; and the timing of construction may be restricted to avoid and minimize effects on federally listed and State-listed threatened and endangered species, such as giant garter snake, Swainson's hawk, and winter-run Chinook salmon. However, work windows can sometimes be extended based on site-specific and seasonal conditions, such as if no rain

is forecast for an extended period. All construction as part of CVFPP management actions would comply with applicable timing restrictions.

2.7.4 Construction Activities

Mobilization

Construction activities begin with a mobilization phase. This phase involves installing temporary construction offices, setting up staging areas, and transporting equipment to the work site.

Staging Areas

One or more staging areas are typically required for storage and distribution of construction materials and equipment. These areas are usually located in or near active construction areas and may be relocated as construction progresses, especially for long linear levee improvement projects. Staging areas often include parking for construction workers and may require acquiring temporary easements from landowners.

Access and Haul Routes

Access and haul routes are designated to haul materials to and from borrow sites, staging areas, and construction sites. Access routes are also used for employee commuting. These routes typically consist of existing public roads near construction sites; however, new off-road haul routes may also be constructed between borrow sites, staging areas, and construction sites. A minor flood protection project may involve only a few trips per day for employee commuting and hauling of equipment and materials. A major flood protection project can require hundreds of trips per day just to haul material from borrow sites to construction sites. Projects involving construction near the water may use barges to transport equipment and materials, using waterways for access.

Site Preparation

Site preparation typically involves clearing the ground of structures, woody vegetation, and any debris. Structures may consist of residences, agricultural outbuildings, irrigation facilities (distribution boxes, wells, standpipes, and pipes), power poles, utility lines, and piping. Preparation may also involve removing any existing stability or seepage berms along a levee. The clearing operation may be followed by grubbing operations to remove trees and other vegetation, stumps, root balls, and belowground infrastructure. In addition, up to 12 inches of earthen material from the ground may be stripped as part of site preparation.

Debris generated during the clearing and grubbing operations can be disposed of via various means, depending on the type of material and local conditions. These materials may be hauled off site to landfills (e.g.,

building demolition waste), delivered to recycling facilities (e.g., concrete), or sold (e.g., organic material to cogeneration facilities). Excess earthen materials, such as organic soils, vegetation, and excavated material, may be temporarily stockpiled before being respread at the project site or used to reclaim borrow sites (see below). No excess materials generated during site preparation or other project activities would be disposed of by open burning.

Preparation of Borrow Sites

Borrow sites are areas from which earthen materials would be removed for use in construction. Sites nearest to the construction areas are usually preferred. Using borrow sites near construction areas reduces the potential costs and environmental effects (air emissions and traffic) of hauling materials to the construction site from greater distances. In addition, when the borrow site is within approximately 1 mile of the point of use, scrapers may be used instead of trucks to move soil material from a borrow site to the construction area, thereby reducing the amount of material that must be handled, associated construction costs, and air pollutant emissions.

Borrow sites are prepared in a similar fashion as construction sites. After structures and woody vegetation are cleared from the surface, stumps, root balls, and infrastructure are removed from below ground. Typically the borrow area is then disked to chop any remaining surface vegetation and mix it with the near-surface organic soils. Next, the top layer (up to 12 inches) of earthen material is stripped from the borrow excavation area and this soil is stockpiled at the borrow site. These soils are typically respread on the surface of the borrow site after the borrow has been excavated and the site has been graded to support reclamation. Debris generated during the clearing and grubbing that is not suitable for inclusion in the stockpiled soil is disposed of as appropriate via the various means described above (e.g., hauled off site to landfills, recycled, or sold for commercial use).

Excavation depths for borrow sites typically range from 2 feet to 10 feet, depending on volume requirements, the quality and extent of material available, and the method of reclaiming the borrow site.

Levee Repair, Reconstruction, or Improvement Activities

Many of the NTMAs and LTMAs included in the proposed program involve repairing, reconstructing, or improving existing levee systems. Construction activities associated with common categories of levee work are described below. These activities generally apply to both setback levees and levees associated with flood bypasses.

Construction of Levee Embankments Constructing levee embankments may involve widening and flattening the landside slope of an existing

levee, expanding the width of the entire levee by widening both the crown and the base, building an entirely new levee adjacent to or set back from an existing levee. During construction, soil borrow (fill) from borrow sites is delivered to the levee construction sites using haul trucks or scrapers, depending on the distance between sites. Scrapers may be used when the borrow sites are relatively close to the levee construction sites (i.e., generally less than 1 mile away). Otherwise, haul trucks are loaded by excavators and travel to the levee construction sites on existing paved or unpaved roads, or temporary unpaved roads. At the levee construction sites, the borrow material is spread by graders and compacted by sheepsfoot rollers or other compaction equipment to build levee embankments. A water truck is used if needed to properly moisture-condition the soils for compaction and to control dust.

Construction of Seepage Berms Seepage berms may be constructed as part of levee embankment construction or as an addition to existing levees. Seepage berms are wide embankments placed landward from the levee's landside toe to lengthen the underseepage path, thereby lowering the exit gradient of seepage through permeable layers under the levees to acceptable levels. Berms typically extend 80–300 feet from the landside toe of the levee. The thickness of a berm depends on the severity of the seepage flow but generally ranges from 5 to 8 feet thick. A common type of seepage berm consists of a drain rock layer covered by a soil layer to control the exit gradient of water seeping through the material that underlies the levee. The water seeps under the levee, enters the drain rock layer, and is controlled/contained within the drain rock layer by the overlying soil later. A geotextile filter fabric is placed between the drainage rock and the native soil below it to prevent the water seeping into the drainage rock from carrying soil with it. The distance that the berm extends from the levee is designed to reduce the hydraulic exit gradient of the seepage water to acceptable levels.

Construction of Cutoff Walls Cutoff walls may be constructed as part of a levee improvement project. These are installed either through the top of the existing levee, along the toe of an existing levee, or as part of the construction of widened or setback levees. Cutoff walls can be constructed by any of several methods to suit site conditions and schedule requirements. The most common methods are to install cutoff walls consisting of a soil-bentonite mix or soil-cement-bentonite (SCB) mix using conventional trench methods or deep soil mixing (DSM). Conventional slurry cutoff walls are typically constructed using an excavator with a long-stick boom capable of digging a trench to a maximum depth of approximately 80 feet. Soil and bentonite (and cement, if needed) are mixed in a batch plant to achieve the required strength and impermeability for the cutoff wall. The mixture is pumped into the trench

and fills the trench as excavation occurs to create the desired cutoff wall and to prevent the trench from caving in as it is excavated. In the DSM method, augers or other equipment are used to mix bentonite (and cement, if needed) with soil as the equipment moves deeper underground. Because the DSM method is not limited by the reach of an excavator boom, cutoff walls more than 100 feet deep can be constructed using this method.

If cutoff walls are installed through an existing levee using excavators, several feet of the levee crown are typically removed before construction to facilitate installation of the cutoff wall. If special installation methods are used, such as DSM, removal of the levee crown may not be required.

Both methods of constructing slurry cutoff walls require that batch plants operate near the excavation area for the cutoff wall so that the needed soil-bentonite or SCB slurries can be prepared with appropriate consistencies and compositions. Batch plants typically require a water source to create the slurry and a storage site for bags of bentonite and potentially cement. Water trucks often provide water to the batch plants. Batch plants may occupy an area of as much as 1,000–2,000 square feet. Plant components may be placed linearly on the crown of a levee, or on the levee toe. Hoses are typically used to move the soil-bentonite or SCB slurry from the batch plant to the cutoff wall trench.

Installation of Pressure Relief Wells Where needed, relief wells can be installed along the landside toe of a levee to intercept and provide controlled outlets for seepage that otherwise would emerge uncontrolled landward of the levee, resulting in sand boils or piping of foundation material. A drill rig bores a hole into the ground to the required depth of the well; the well casing, well screen sections, and filter pack are installed; and the well is finished by pumping water from it to clean out the bentonite drilling fluid and to consolidate the well's gravel pack. After the solids are settled out, water from the well development operations is discharged to adjacent fields or drainage ditches. Pressure relief well systems are often used where pervious strata underlying a levee are too deep or too thick to be penetrated by cutoff walls or toe drains.

Site Restoration and Demobilization

When construction activities are complete, any material stripped from the soil surface during site preparation is placed on appropriate facilities (e.g., levees and seepage berms) and on any temporarily disturbed areas where topsoil was removed. Levee slopes, seepage berms, and temporarily disturbed areas (as appropriate) are seeded with appropriate herbaceous seed mixes. An aggregate-base patrol road may be constructed on the crown of the new levee or near the landside edge of the seepage berm, or both. Any remaining construction debris is hauled to an appropriate waste

facility. Equipment and materials are removed from the site, and staging areas and any temporary access roads are restored to preproject conditions (e.g., stabilized with an herbaceous seed mix, planted for restoration to native habitat, and returned to agricultural production). Demobilization is likely to occur in various locations as construction proceeds through larger or linear project areas.

Noncommercial borrow sites are restored or reclaimed by replacing topsoil that has been set aside and regraded to allow for continued uses such as farming, or may be converted to other uses such as habitat restoration sites. For setback levee projects, material from the original levee that is replaced by the setback levee may be used to refill the borrow site.

Disposal of Excess Materials

Excess organic materials consist of woody vegetation, grasses, and roots from borrow areas and levee construction sites; excavated material that does not meet levee embankment criteria; and soil not used or not suitable for the earthen structure under construction. Organic materials are typically used to reclaim borrow areas and temporarily disturbed sites and/or provided to local farmers for incorporation into their land to improve soil quality.

Rock Revetment

Levee projects may also involve placing rock riprap revetment (a facing such as stone or concrete), generally on the waterside of the levee. Rock provides structural integrity and erosion protection to the levee prism. Frequently, this material is installed as a rock/soil mixture to fill voids in the rocks and may provide a substrate for vegetation plantings, subject to approval by either USACE or the Board or both. The size of the rock to be installed is typically determined based on an engineering evaluation that accounts for the anticipated erosive power of the river at the location. Gradations in rock sizes may also be considered for the benefit of migratory special-status fish species. Rock may be installed using equipment on the levee crown, along the waterside levee toe if no water is present and access is available, or from barges if the edge of the waterway is near the levee toe.

2.7.5 Environmental Considerations

Before construction, the proponent of a flood protection project typically implements certain environmental considerations that are now standard practice for avoiding and minimizing construction-related impacts. Some of the more common types of environmental considerations related to construction activities for flood protection projects are discussed below.

The project proponent typically prepares and implements a storm water pollution prevention plan and complies with the conditions of the National Pollutant Discharge Elimination System's current general stormwater permit for construction activity. The storm water pollution prevention plan describes the construction activities to be conducted, best management practices to be implemented to prevent discharges of contaminated stormwater into waterways, and construction monitoring and inspection activities to be conducted.

Water trucks and any other necessary dust control measures are used to suppress dust during earth-moving activities or other use of nonpaved roads, consistent with the requirements of local air quality management districts or air pollution control districts.

Development of borrow sites may require compliance with the State's Surface Mining and Reclamation Act (SMARA) (California Public Resources Code, Section 2714). SMARA compliance is often implemented by county governments. Borrow sites that meet certain requirements may receive an exemption from securing a permit under SMARA.

The project proponent typically conducts any necessary preconstruction biological and cultural resource surveys of the project construction area, and implements specific mitigation measures if certain special-status species or cultural resource sites are found within and/or adjacent to the project footprint.

All required permits and other authorizations will also need to be obtained by the project proponents, as described above in Section 2.5.1, "Implementation in Accordance with Applicable Laws and Regulations," and all permit conditions, mitigation measures, or other limitations fully satisfied during project implementation.