ERP Proposal Application Form

For DFG use only	
Proposal No.	Region

Section 1: Summary Information

1. Project title:	McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project
2. Applicant name:	Reclamation District 2110
3. Contact person:	Leo Winternitz
4. Address:	2015 J Street, Suite 103
5. City, State, Zip:	Sacramento, CA 95811
6. Telephone #:	(916) 449-2850 ext. 4105
7. Fax #:	(916) 448-3469
8. Email address:	lwinternitz@tnc.org
9. Agency Type:	Federal Agency ☐ State Agency ☐ Local Agency ☒ Nonprofit Organization ☐ University (CSU/UC) ☐ Native American Indian Tribe ☐
10. Certified nonprofit organization:	Yes ☐ No ☒
11. New grantee:	Yes ☒ No ☐
12. Amount requested:	$3,314,300
13. Total project cost:	$21,782,200
14. Topic Area(s):	Primary: Lowland Floodplains and Bypasses Secondary: At-Risk Species Assessment; Ecosystem Water and Sediment Quality; Estuary Foodweb Productivity; Hydrodynamics, Sediment Transport and Flow Regimes; Non-native Invasive Species; Riparian Habitat; River Channel Restoration; Shallow Water and Marsh Habitat
15. ERP Project type:	Primary: Monitoring, Planning, Full-scale Implementation, Pilot/Demonstration Secondary: Research
16. Ecosystem Element:	Primary: Natural Floodplain and Flood Processes Secondary: Freshwater Fish Habitats, Fresh Emergent Wetland, Nontidal Perennial Aquatic Habitat; Riparian and Riverine Aquatic Habitats, Tidal Perennial Aquatic Habitat, Dredging and Sediment Disposal,
17. Water Quality Constituent:	Turbidity and Sedimentation
18. At-Risk species benefited:	Wildlife: Central Valley Fall-run and late Fall-run Chinook Salmon, Central Valley Spring-run Chinook Salmon, Sacramento River Winter-run Chinook Salmon, Delta Smelt, Central Valley Steelhead, Swainson's Hawk, Great Blue Heron, Greater Sandhill Crane, California Black Rail, Giant Garter Snake Plantlife: Mason's Lilaeopsis, Delta Tule Pea, Rose-Mallow
19. Project objectives:	The purpose of the McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project is to implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. Flood control improvements are needed to reduce damage to land uses, infrastructure, and the Bay-Delta ecosystem resulting from overflows caused by insufficient channel capacities and catastrophic levee failures within the Project study area. As a component of the North

	Delta Flood Control and Ecosystem Restoration Program, the McCormack-Williamson project, in conjunction with other North Delta project components, will have far reaching flood control and ecosystem benefits for 197 square miles of the Delta. The Project objectives are split into three subgroups: flood control, ecosystem restoration, and recreation, as follows. **Flood control** • Convey floodflows to the San Joaquin River without immitigable stage impacts. • Reduce the risk of catastrophic levee failures based on the 1997 event for stage and the 1986 event for volume. • Control floodwaters coming through McCormack-Williamson Tract in a way that minimizes the surge effects (i.e., avoids the historical occurrence when a large pulse of water from McCormack-Williamson Tract adversely affected adjacent island levees (e.g., Tyler and Staten Islands) and downstream flows and knocked boats loose from local marina moorings in flood events). **Ecosystem Restoration** • Implement science-driven pilot programs to restore ecologic, hydrologic, geomorphic, and biologic processes and self-sustaining habitats, including freshwater tidal marsh, seasonal floodplain, riparian, and other wetland habitats. • Support special-status species. • Limit exotic species establishment. • Promote foodweb productivity. • Promote natural flooding processes and tidal action. • Promote processes to increase land surface elevations in areas of subsidence. **Recreation** • Enhance public recreation opportunities in a manner that does not compromise flood protection infrastructure or operations, comprise habitat integrity, or disturb wildlife.
20. Time frame:	June 2011 – June 2013: Planning Phase (design, survey, and permitting) January 2013 – December 2015 Construction Phase June 2012 – December 2017: Monitoring and Management Phase (preconstruction / construction monitoring and post-construction management / operation to ensure proper functioning of improvements and restoration plantings)

Section 2: Location Information

1. Township, Range, Section: and the 7.5 USGS <u>Quad map name</u>.	Mt. Diablo Meridian T5N, R4E, sec25 Bruceville and Thornton Quad map
2. Latitude, Longitude (in decimal degrees, Geographic, NAD83):	38˚ 15’ 121˚ 29’
3. Location description:	The Project site location is near the confluence of the Mokelumne and Cosumnes Rivers
4. County(ies):	Sacramento

5. Directions:	East from Walnut Grove along Walnut Grove-Thronton Road
6. Ecological Management Region	Delta and Eastside Tributaries
7. Ecological Management Zone(s):	Sacramento-San Joaquin Delta
8. Ecological Management Unit(s):	East Delta
9. Watershed Plan(s):	Cosumnes River Preserve Management Plan
10. Project area:	1,654 acres
11. Land use statement	The Project site currently consists of agricultural land. It is part of the Cosumnes River Preserve and is planned for flood control and ecosystem restoration
12. Project area ownership:	100% Private (The Nature Conservancy)
13. Project area with landowners support of proposal:	Land is owned by The Nature Conservancy. Reclamation District 2110 is the Applicant for this grant; and a CEQA document analyzing the Project was certified by DWR in 2010.

Section 3: Landowners, Access and Permits

1. Landowners Granting Access for Project: (Please attach provisional access agreement[s])

The landowner granting access for this project would be The Nature Conservancy. A provisional access agreement is provided on page 4 of this application.

2. Owner Interest:

Fee title.

3. Permits:	See Appendix A. A description of required permits is included in the Mitigation, Monitoring, and Reporting Program for the North Delta Flood Control and Ecosystem Restoration EIR.
4. Lead CEQA agency:	DWR (for the North Delta Flood Control and Ecosystem Restoration Project EIR) RD 2110 for subsequent CEQA / NEPA compliance in consultation with USACE. Lead and responsible agency status will confirmed through implementation of the Project Management Plan executed between USACE and RD 2110 (see Appendix D)
5. Required mitigation:	Yes ☒ No ☐ Note: Required mitigations are listed in Appendix A, Mitigation, Monitoring, and Reporting Program (from the North Delta Flood Control and Ecosystem Restoration Project EIR)

ERP Proposal Application Form

Provisional Landowner Access Agreement

Reclamation District 2110
2015 J Street, Suite 103
Sacramento, CA 95811

1. Purpose

The following agreement details the requirements of both the landowner and Reclamation District 2110 (RD 2110) regarding the McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project. Said property is located near the confluence of the Mokelumne and Cosumnes Rivers.

I, The Nature Conservancy (TNC), hereinafter called "Landowner," am aware that a habitat restoration project grant application has been submitted to the CALFED Ecosystem Restoration Program (ERP) for funding. I support the goals of the project. TNC is the sole owner of the McCormack-Williamson Tract, which comprises the entirety of RD 2110. There is a close association and working relationship between the governing board of RD 2110 and TNC. RD 2110 manages and maintains the levees on the McCormack-Williamson Tract and there is an on-going access agreement.

II. Access Permission

Landowner hereby grants Department of Fish and Game (DFG), NOAA's National Marine Fisheries Service, and U.S. Fish and Wildlife Service (USFWS) representatives permission to enter onto real property owned by the Landowner to perform pre-project evaluations. Access shall be limited to those portions of Landowner's real property where actual restoration work is proposed to be performed and those additional portions of real property that must be traversed to gain access to the work site. At no time will DFG, NOAA Fisheries Service, or USFWS representatives access the property without the applicant, unless expressly given permission by the Landowner.

III. Duration of Notice

This agreement shall commence upon signing and be maintained while TNC remains Landowner of the property.

IV. Liabilities

Reasonable precautions will be exercised by RD 2110 to avoid damage to persons and property. RD 2110 agrees to indemnify and hold harmless the Landowner and agrees to pay for reasonable damages proximately caused by reason of the uses authorized by this agreement, except those caused by the gross negligence or intentional conduct of the Landowner.

Leo Winternitz 2/28/11
Landowner Signature Date

2015 J Street, Suite 103, Sacramento, CA 95811
Landowner Address

(916) 449-2850
Landowner Phone Number

Leo Winternitz 2/28/11
Applicant Signature Date

Department of Fish and Game Ecosystem Restoration Program 4

Section 4: Project Objectives Outline

1. List task information:

Goal 2: Ecological Processes: Rehabilitate natural processes in the Bay –Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitat, in ways that favor native members of those communities.

Objective 1: Establish and maintain hydrologic and hydrodynamic regimes for the Bay and Delta that support the recovery and restoration of native species and biotic communities, support the restoration and maintenance of functional natural habitats, and maintain harvested species.

Objective 2: Increase estuarine productivity and rehabilitate estuarine food web processes to support the recovery and restoration of native estuarine species and biotic communities

Objective 3: Rehabilitate natural processes to create and maintain complex channel morphology, in-channel islands, and shallow water habitat in the Delta and Suisun Marsh

Objective 4: Create and/or maintain flow and temperature regimes in rivers that support the recovery and restoration of native aquatic species

Objective 5: Establish hydrologic regimes in streams, including sufficient flow timing, magnitude, duration, and high flow frequency, to maintain channel and sediment conditions supporting the recovery and restoration of native aquatic and riparian species and biotic communities

Objective 6: Reestablish floodplain inundation and channel-floodplain connectivity of sufficient frequency, timing, duration, and magnitude to support the restoration and maintenance of functional natural floodplain, riparian, and riverine habitats

Objective 7: Restore coarse sediment supplies to sediment-starved rivers downstream of reservoirs to support the restoration and maintenance of functional natural riverine habitats

Objective 8: Increase the extent of freely meandering reaches and other pre-1850 river channel forms to support the restoration and maintenance of functional natural riverine, riparian, and floodplain habitats

The purpose of the McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project is to implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes, as described in greater detail in this application. Flood control improvements are needed to reduce damage to land uses, infrastructure, and the Bay-Delta ecosystem resulting from overflows caused by insufficient channel capacities and catastrophic levee failures within the Project study area.

2. Additional objectives:

The Project objectives are split into three subgroups: flood control, ecosystem restoration, and recreation, as follows.

Flood control

- Convey floodflows to the San Joaquin River without immitigable stage impacts.
- Reduce the risk of catastrophic levee failures based on the 1997 event for stage and the 1986 event for volume.
- Control floodwaters coming through McCormack-Williamson Tract in a way that minimizes the surge effects (i.e., avoids the historical occurrence when a large pulse of water from McCormack-Williamson Tract adversely affected adjacent island levees (e.g., Tyler, Dead Horse and Staten Islands) and downstream flows and knocked boats loose from local marina moorings in flood events).

Ecosystem Restoration

- Implement science-driven pilot programs to restore ecologic, hydrologic, geomorphic, and biologic processes and self-sustaining habitats, including freshwater tidal marsh, seasonal floodplain, riparian, and other wetland habitats.
- Support special-status species.
- Limit exotic species establishment.
- Promote foodweb productivity.
- Promote natural flooding processes and tidal action.

- Promote processes to increase land surface elevations in areas of subsidence.

Recreation

- Enhance public recreation opportunities in a manner that does not compromise flood protection infrastructure or operations, comprise habitat integrity, or disturb wildlife.\

3. Source(s) of above information:

California Department of Water Resources. 2010. North Delta Flood Control and Ecosystem Restoration Project Environmental Impact Report. Prepared by Jones and Stokes. Available: http://www.water.ca.gov/floodmgmt/dsmo/sab/ndp/documents/. Accessed: February 2011.

CalFed Levee Stability Program McCormack-Williamson Tract, California Feasibility Study Project Management Plan (Appendix D)

Section 5: Conflict of Interest

To assist ERP staff in managing potential conflicts of interest as part of the review and selection process, we are requesting applicants to provide information on who will directly benefit if your proposal is funded. Please provide the names of individuals who fall in the following categories:

- Persons listed in the proposal, who wrote the proposal, will be performing the tasks listed in the proposal, or who will benefit financially if the proposal is funded; and/or
- Subcontractors listed in the proposal, who will perform tasks listed in the proposal, or will benefit financially if the proposal is funded.

Primary Contact for Proposal: Leo Winternitz

Primary Investigator: N/A

Co-Primary Investigator: N/A

Supporting Staff: N/A

Subcontractor: AECOM

Provide the list of names and organizations of all individuals not listed in the proposal who helped with proposal development along with any comments.

Last Name	First Name	Organization	Role
Lowenthal	Marianne	AECOM	Document Preparation
Goldman	Jeff	AECOM	Reviewer/Editor

Section 6: Project Tasks and Results Outline

1. Detailed Project Description

Project Summary

McCormack-Williamson Tract is a 1,654-acre “island” farm located in the north Delta downstream of the confluence of the Cosumnes and Mokelumne Rivers (Exhibit 1). The Project will implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species and ecological processes. McCormack-Williamson plays a key role in north Delta hydraulics. The property typically floods by overtopping at the northeast end during large flood events and then breaches downstream in an uncontrolled fashion, causing stress and sometimes failure to adjacent levees and local marina moorings. The project is intended to allow passing of flood flows through the tract, in a way that minimizes flood impacts to the system. Because the tract’s topography varies from roughly plus five feet above sea-level to minus four feet, the tract provides

an ideal landscape gradient for a continuum of habitat types that provides for ecosystem benefits. The flood control / ecosystem restoration project is well supported by area landowners who have been affected by the catastrophic nature of flooding on McCormack-Williamson for years.

The island was purchased in 1999 by The Nature Conservancy (TNC) using $5.2 million in federal funding granted from U.S. Fish and Wildlife Service (USFWS) to TNC through the CALFED Bay Delta Program. Because of its location and elevation, the tract has been viewed as a prime site for restoration of freshwater marsh, seasonal wetlands and riparian forest for over 20 years. When TNC purchased McCormack-Williamson Tract it also became the sole landowner in Reclamation District 2110 (RD 2110). Formed under California law, reclamation districts are a type of local government that delivers specific public services within defined boundaries. In the case of RD 2110, the district manages and maintains the levees on the McCormack-Williamson Tract. As a governmental agency, it is eligible for subvention payments, which a private landowner would not be. The district is directed by a board of 3 trustees who are elected by the sole landowner, RD 2110 does not have any employees and relies on staff from the Nature Conservancy and contractors to implement projects. Appendix B contains further details of the project design. Figure 1 (below) shows the project location with respect to the Cosumnes River Preserve.

The proposed project involves construction of the flood control and ecosystem restoration project. RD 2110 will work with USACE to manage project implementation, including oversight of contractors and compliance with permit requirements. This task includes site preparation, structural work, and non structural work : Preliminary Operation and Maintenance Plan, for project details). Project implementation will include ground preparation, such as disking weeds and constructing planting rows, moving soils to form wetland basins that will allow for fish passage as floods recede, irrigation restoration (installation and /or reuse or pumps to service the needs of the riparian vegetation planting and to provide water to the wetlands during non-flood years).

The McCormack-Williamson Tract Project is estimated to cost $21,782,200. In recognition of the socio-economic and environmental importance of the Delta and the serious threat of levee failures with disastrous and wide-spread consequences, Project management and oversight costs by the District's engineer ($50,000) are covered in the agreement between RD 2110 and DWR. The Army Corps would provide a cost match of 65% ($12.675 million), with 35% coming from the non-federal sponsor ($6.825 million). DWR has agreed to provide the non-federal sponsor with 80% of the non-federal sponsor's costs share ($5.46 million) so the non-federal sponsor will only need to provide the remaining 20% ($1.365 million), or 7% of the total project cost. This proposal solicitation package would be used to cover the 7% cost share for project design and construction ($1.365 million). In addition, this application seeks $1.95 million (10% of project design and construction cost) for pre and post construction monitoring and focused research. There will also be administrative and contingency costs associated with the project. (The value of the land cannot count as part of the non-federal cost share because the land was purchased with federal funds.)

Project Need

The northern region of the Delta (North Delta) faces the need to balance the same issues and multi-use objectives as the larger estuary, particularly with regard to flood control and ecosystem restoration. Specifically, runoff from the Sacramento, San Joaquin, Mokelumne, and Cosumnes Rivers during large storm events has caused flooding of homes, infrastructure, farms, and other businesses in the North Delta. Additionally, degradation and the loss of aquatic and terrestrial habitat are primary concerns in the North Delta. The Project addresses the need for flood control solutions that are integrated with ecosystem improvements. The existing and historical conditions that warrant flood control and ecosystem quality improvements are described below.

Flood Control

The Mokelumne and Cosumnes Rivers and the Morrison Creek stream group do not currently have sufficient channel capacity to safely convey peak historical flows from Sierra Nevada watersheds, such as occurred during the 1986 and 1997 flood events, through the North Delta to the San Joaquin River. Current channel capacities for the North and South Forks of the Mokelumne River are approximately 40,000 cubic feet per second (cfs). By comparison, the combined channel capacity required to safely convey flows from a 100-year flood event has been estimated at 90,000 cfs. During peak flows, water from the Mokelumne River backs up into a broad floodplain north of New Hope Tract, and the limited capacity further causes water to back up into Snodgrass Slough to the north toward Lambert Road. The lack of channel capacity, combined with other constrictions in vulnerable areas (e.g., bridge abutments) and an increase in sedimentation levels, makes a number of areas in the North Delta vulnerable to flooding. Since 1955, several areas have been flooded after levees failed (by breaches or overtopping), including the Point Pleasant area, McCormack-Williamson Tract, Tyler Island, Dead Horse Island, New Hope Tract, Canal Ranch Tract, Glanville Tract, and Franklin Pond area. The potential for flooding also threatens important public facilities and institutions in the North Delta area, including Interstate 5 (I-5), the Union Pacific Railroad line, and the Rio Cosumnes Correctional Center.

A particular phenomenon associated with levee failure on McCormack- Williamson Tract is the "surge effect" created by the sudden rush of water over the island when the levee breaches or is overtopped. The force of the water from the surge

effect rushes across the island from the northeast to the southwest, ultimately reaching the Walnut Grove and Wimpy's/New Hope marinas. At this point, the surge can displace mobile homes, damage infrastructure, and break boats loose from their moorings. As evidenced in past flood events, flood damage can be considerable when this occurs, as the loosed boats can become lodged against the New Hope Bridge, compounding the channel constriction with other debris. The channel constriction causes water surface elevation to rise and create a back-up condition upstream and unstable conditions on adjacent areas. The overall result historically has constituted substantial property damage and threat to human safety, both in the immediate area and on adjacent islands.

Ecosystem Restoration

Degradation and the loss of habitats that support various life stages of aquatic and terrestrial species are a primary concern in the North Delta. These habitat changes come from many causes, including sedimentation from hydraulic mining, habitat conversion, water diversions, and the introduction of exotic species. Thirty years of nineteenth century

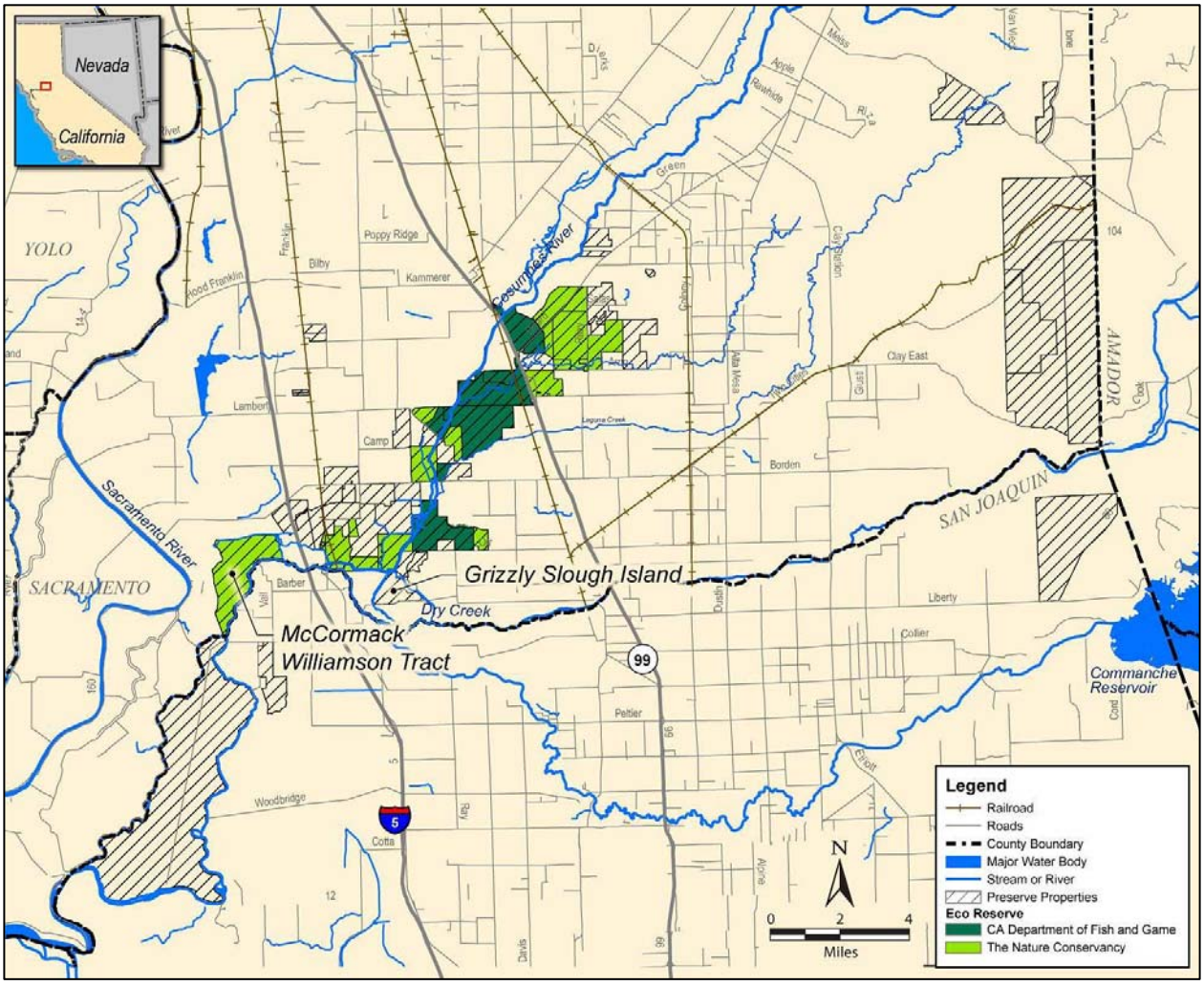


Figure 1: Cosumnes River Preserve Lands

Source: Cosumnes River Preserve 2008

hydraulic mining in the river drainages along the eastern edge of the Central Valley have increased sedimentation levels in downstream watercourses, degrading valuable aquatic habitat. Many of the seasonally inundated lands in the Bay-Delta system that historically provided habitat to a variety of bird and animal species have been converted to agricultural, industrial, and urban uses. Levees constructed to protect lands in the Delta from inundation and to channelize flow to flush out sediment eliminated fish access to shallow overflow areas, and dredging to construct levees eliminated the tule bed habitat along the river channels. Upstream water development and use, depletion of natural flows by local diverters, and the diversion of water from the Bay-Delta system have altered hydrodynamic processes. This has resulted in changed seasonal patterns of inflow, reduced Delta outflow, and diminished natural variability of flows into and through the Bay-Delta system. Those facilities constructed to support water diversions may result in straying or direct losses of fish and can increase exposure of juvenile fish to predation.

Recreation

The Delta is highly attractive for numerous recreational uses, including motorized and non-motorized boating, fishing, hunting, and wildlife viewing. Much of the North Delta is privately owned, including the levees that contain its hundreds of miles of waterways. Because of these ownership patterns, designated public access points are relatively few. Illicit access (i.e., trespassing through private property) is highly common and problematic for several reasons such as:

- erosion of levee material and displacement of rock revetment, which compromises the integrity of the levee cross section;
- degradation of vegetation and habitat;
- fish and wildlife poaching;
- trash dumping;
- illegal campfires;
- unsafe parking and effects on circulation;
- difficult access for law enforcement and emergency services; and
- vandalism to agricultural and reclamation district infrastructure.

Safe and convenient public recreation access and infrastructure clearly are needed to meet current and future demand.

Hypotheses Testing

Scientific uncertainties are inherent in this major ecological restoration project. Hypotheses testing would primarily be implemented through the Project's adaptive management plan. The North Delta EIR includes the adaptive management plan as part of the project description for the Project's operation and maintenance plan (DWR 2010). The adaptive management plan generally consists of performance measures (i.e., research questions), success criteria (i.e., hypotheses), and adaptive management responses (i.e., potential research opportunities). Although much of the detail remains to be developed, Appendix E provides a general overview of the intended approach to the adaptive management plan.

Project Location

The Project site is located in the North Delta near the Mokelumne and Cosumnes River confluence. Figure 2 shows the location of the Project.

2. Background and Conceptual Models

North Delta Flood Control and Ecosystem Restoration Project

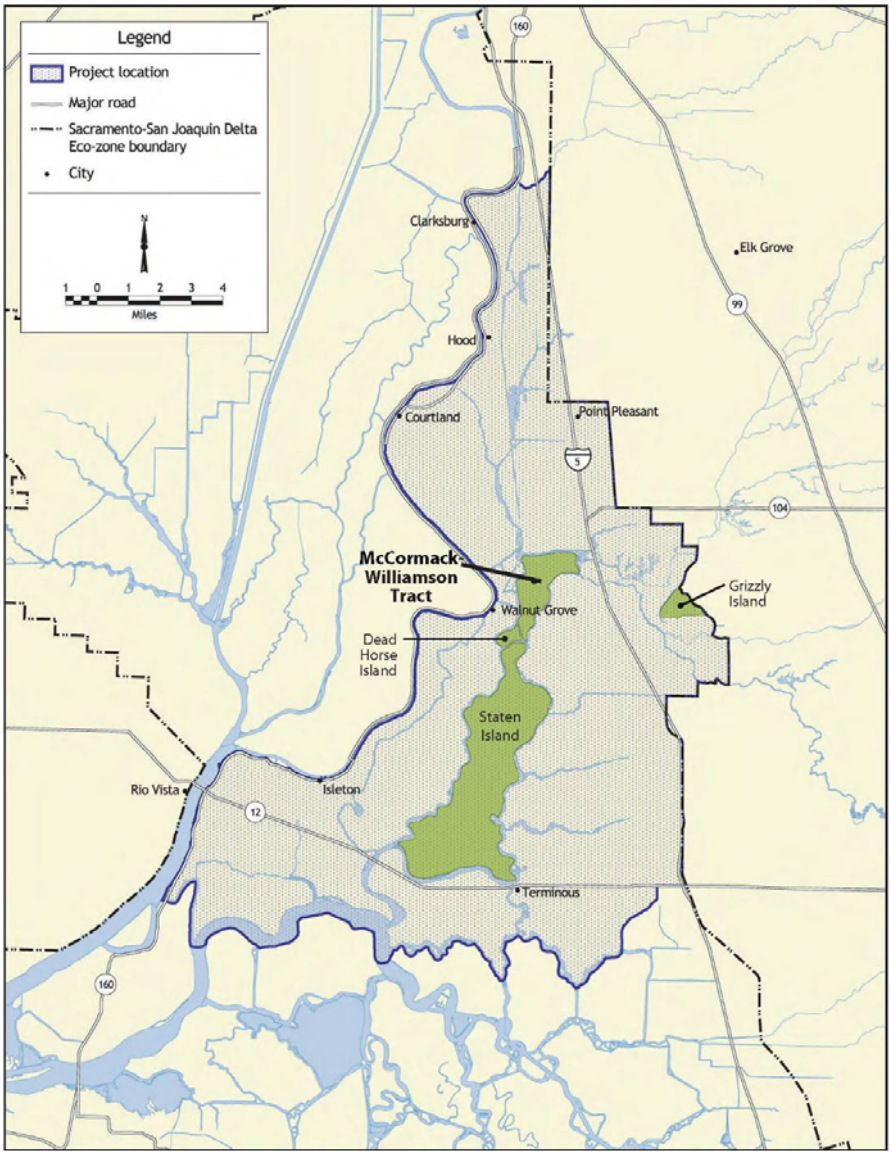
Because of ongoing conveyance, flood control, and ecosystem health issues, improvements in the North Delta have been the focus of planning efforts for many years. In 1987, DWR launched a planning and environmental documentation process for the North Delta Program, which led to the release of a draft EIR/EIS in 1990. Many of the elements and objectives of the 1990 effort were similar to the 2007 North Delta Project EIR; however, one important difference is that the Draft 1990 EIR/EIS included water supply and conveyance benefits from modification of the Delta Cross-Channel. These elements are now being studied under separate efforts, namely the Delta Cross-Channel Re-operation studies and Through-Delta Facility studies (see later in this chapter and the CALFED Bay-Delta Program Programmatic Record of Decision, Volume 1, page 50, for background on implementation of the North Delta conveyance plan). The 1990 Draft EIR/EIS identified that any potential area conveyance benefits were derived largely from Delta Cross-Channel modifications. Therefore, although Delta Cross-Channel Re-operation studies, Through- Delta Facility studies, and North Delta Flood Control and Ecosystem Restoration actions are being coordinated, conveyance improvements are not a primary purpose of the Project.

In 1995, DWR suspended the North Delta planning efforts in deference to the CALFED Bay-Delta Program. The goals of the 1990 North Delta EIR/EIS were substantially absorbed into the CALFED Program and restructured as the North Delta Flood Control and Ecosystem Restoration improvements and the Delta Cross-Channel Re-operation and Through-Delta Facility studies mentioned above. While the CALFED Bay-Delta Program was completing the Programmatic Bay-Delta EIR/EIS, CALFED staff convened the North Delta Improvement Group (NDIG) to initiate North Delta flood improvements planning. The group focused early planning efforts on preparation of the "DRAFT White Paper on North Delta Improvements," (White Paper) dated July 2000, to capture the complex history of the area, the then-current related planning efforts, and preliminary planning research.

In 1999, TNC obtained $5.6 million in CALFED Ecosystem Restoration Program (ERP) funds to purchase the approximately 1,600-acre McCormack-Williamson Tract for ecosystem restoration and flood control. Also in 1999, UC Davis) researchers and DWR obtained CALFED ERP funds in complementary proposals. UC Davis researchers received $556,200 to conduct historical research and baseline studies for restoration planning and a monitoring program, and DWR received $355,000 for restoration planning and design of engineering alternatives. The UC Davis research included analysis of historical hydrogeomorphic conditions, the modern hydrologic and sedimentologic regime, baseline studies of aquatic resources and riparian resources, and development of data management and monitoring systems. This study is attached as Appendix F.

DWR met with the CALFED ERP Steering Committee throughout 2001 and 2002 to obtain guidance on ecosystem restoration concepts for the Project. The Steering Committee advised DWR staff to submit ecosystem restoration proposals in the CALFED Ecosystem Restoration Proposal Solicitation Process. In 2003 and 2004, DWR convened a series of ecological coordination meetings with agency and nonprofit scientists to develop ecosystem restoration concepts for the Project and to address comments received in public scoping sessions. The ecological restoration coordination team consisted of representatives from DFG, USFWS, the National Marine Fisheries Service (NMFS), TNC, and the California Bay-Delta Authority (CBDA) and met regularly throughout 2003–2004.

The Draft EIR for the North Delta Flood Project was released for public comment in November 2007 for a 60 day review period. DWR certified the EIR and adopted a Statement of Findings, Statement of Overriding Considerations, and a Mitigation, Monitoring, and Reporting Program in November 2010.



Conceptual Models

Ecological Conceptual Model

DWR and TNC scientists met with the CALFED ERP Steering Committee throughout 2001 and 2002 to obtain guidance on ecosystem restoration concepts for the Project. The Steering Committee advised DWR staff to submit ecosystem restoration proposals in the CALFED Ecosystem Restoration Proposal Solicitation Process. In 2003 and 2004, DWR and TNC convened a series of ecological coordination meetings with agency and university scientists to develop ecosystem restoration concepts for the Project and to address comments received in public scoping sessions. The ecological restoration coordination team consisted of representatives from the California Department of DFG, the USFWS, NMFS, TNC, and CBDA and met regularly throughout 2003 and 2004.

. Ecological conceptual models were developed over an extended period time by knowledgeable scientists in response to recommendations from science panel of early North Delta Project ecosystem restoration concepts. The North Delta Project EIR included three ecological conceptual models for ecosystem restoration at the McCormack-Williamson Tract: Ecological Option 1 (i.e., the Proposed Project) Conceptual Model was designed to promote sedimentation through fluvial and, to a lesser extent, tidal processes; Ecological Option 2 Conceptual Model was designed to benefit floodplain spawning fish and to discourage exotics; and Ecological Option 3 (alternative, not adopted) Conceptual Model was designed to benefit floodplain spawning for fish and provide a subsidence reversal demonstration project area in the south.

Ecological Option 1 was adopted as part of certification of the North Delta EIR. This conceptual model was based upon the following objectives:

- Promote natural flooding processes
- Improve river floodplain connectivity
- Promote foodweb productivity and water exchange with adjacent channels
- Restore freshwater tidal marsh, seasonal floodplain, and riparian habitats
- Promote bioaccretion and sedimentation through flooding, riverine and tidal processes
- Allow channel migration
- Support special status species
- Limit exotic species establishment

Overall, it was determined that riverine and flooding processes would be restored to McCormack-Williamson Tract by breaching the Mokelumne River levee and degrading the entire southwest levee. By opening the system to riverine, flooding and tidal processes, natural processes may be restored. Channel and floodplain habitats, dendritic intertidal channels, emergency marsh, and open-water are expected outcomes of implementation of Option 1. Flooding may affect any dendritic intertidal channel development, which may occur by filling in any channels that form. Over time, with enhanced flooding and tidal processes, bioaccretion and sedimentation may result in increased elevations. These conclusions were based upon the following overall hypotheses:

- Natural processes (flooding, riverine, and tidal) can be restored by opening the McCormack-Williamson Tract to adjacent channels;
- Channel and floodplain habitats, dendritic intertidal channels, emergent marsh and open-water habitats should exist;
- dendritic intertidal channels may be disturbed due to flooding events, but should reform during the summer months; and
- Elevations should increase over time due to bioaccretion and enhanced sedimentation.

The model evaluated several topic areas: hydrology, natural flooding processes, riverine processes, dendritic Intertidal Channels, open water/tule marsh, and riparian habitats. This analysis resulted in a series of hypotheses resulting from implementation of the Project:

Natural Flooding Processes

- Many flooding events (approximately 10 per year), are anticipated to occur through the Mokelumne River breach.
- Annual flood events(1 -3 per year or more in wet years), will occur over the entire east levee.
- Suspended sediment may be deposited in the Tract from flooding and tidal processes.
- Native riparian trees such as willows and cottonwoods will establish on the higher areas of the floodplain.
- Vegetation may increase sediment capture.
- There will not be substantial fish stranding on the floodplain because the majority of the Tract will be hydrologically connected to the outer channels on a daily basis.

Riverine Processes

- A breach in the McCormack-Williamson Tract levee will allow Mokelumne River water to flow onto the Tract.
- Excavation of a starter channel will facilitate flow onto the McCormack-Williamson Tract.
- Nonnative vegetation and fish will not dominate the channels.
- The starter channel will remain open water and not clog due to emergent vegetation or deposited sediment.

Dendritic Intertidal Channels

- Dendritic intertidal channels will form over time in areas greater than 0.5 National Geodetic Vertical Datum (NGVD).
- There will not be permanent water in fingers of the intertidal dendritic channels.
- Enough tidal energy will be retained from water moving through the southern breach to form tidal channels in the central portion of the Tract.
- Dendritic intertidal channel habitat will contribute to the Delta foodweb.

Open Water/Tule Marsh

- The southern portion of the McCormack-Williamson Tract will be open-water with gradual transition to tules as elevations are increased.
- Sedimentation will occur as the result of tidal action.
- Sedimentation will be enhanced when the Delta Cross Channel is open and Sacramento River water is in the area.
- Warm-water fish and submerged aquatic vegetation will colonize the open-water area.
- Dense tule growth in the southern portion of the McCormack-Williamson Tract may prevent establishment of submerged aquatic vegetation.
- Tules will persist in the southern portion of the McCormack-Williamson Tract after inundation.
- Adding dredged material before opening the McCormack-Williamson Tract will increase elevations and may lessen likelihood of submerged aquatic vegetation establishment.

Riparian

- Wildlife-friendly levees will add stability to the land-side of the perimeter levees.
- Wildlife-friendly levees will provide upland, riparian, scrub/shrub, emergent marsh and mudflat (when interior flooded) habitat.

Tidal and Flood Hydraulic Modeling

Quantitative assessment of the North Delta Project was analyzed using the Mike 11 hydraulic modeling tool. The MIKE 11 model, developed by the Danish Hydraulic Institute is a dynamic, one-dimensional modeling package, which simulates the water level and flow splits throughout a river/channel system. In addition to simulating hydraulics, the modeling package also includes modules for advection-dispersion, sediment transport, water quality, rainfall-runoff, flood forecasting, and GIS floodplain mapping and analysis. The hydraulic and sediment transport modules were developed and used to analyze potential impacts and benefits of the North Delta Project.

Boundary condition data for the MIKE 11 model was gathered from a number of gages in the North Delta Project vicinity and has been provided by a number of agencies including U.S. Geological Survey, DWR, East Bay Municipal Utility District, and the Sacramento Area Flood control Agency. The model extends upstream to hydraulic gages located at Michigan Bar on the Cosumnes River, Wilton Road on Deer Creek, above Galt on Dry Creek, Woodbridge on the Mokelumne River, and to Lambert Road at the Stone Lake outfall. To the west, the model includes a short portion of the Sacramento River extending from above the Delta Cross Channel to below the divergence of Georgiana Slough. Downstream boundary conditions include the Mokelumne River at Georgiana Slough, Little Potato Slough downstream of Terminous Tract and the San Joaquin River.

The MIKE 11 model has been calibrated for a range of hydrologic events from large storm events to intermediate and low river flows. This includes simulation of the 1997 and 1986 flood events, and the 1998, 1999, and 2000 intermediate and low flows. Calibrating the MIKE 11 to a wide range of flows has ensured a robust model and has provided a tool that can easily determine comparative benefits and impacts of the integrated flood control and ecosystem restoration options. In general, high flow-event modeling has been used to evaluate the flood control performance of the integrated flood control and ecosystem restoration options, and low and intermediate flow – event modeling (in addition to high flow-event modeling) has been used to evaluate ecosystem restoration performance of the options.

Sedimentation Study

Sediment transport models were developed for five different flood control and ecosystem restoration alternatives proposed by DWR for the North Delta Project. Each of the models was created by altering the geometry of the baseline model to reflect changes proposed by a particular project option. The goal of the modeling was to identify large-scale and long-term sedimentation trends in the study area under existing conditions and to note significant changes in these trends due to implementation of each proposed alternative.

The MIKE 11 model, discussed above under, "Tidal and Flood Hydraulic Modeling," was updated using revised network and geometry files created by UC David in mid 2005. Special attention was paid to changes made to channel reaches near the study area, which included the Mid Mokelumne, Snodgrass Slough, Dead Horse Cut, and the North and South Forks of the Mokelumne. Once a state baseline model had been created and tested, it was used as a basis for developing the sediment transport models of the five alternative project configurations. Changes to the baseline model that reflected the proposed alternative geometries were copied from UC Davis's MIKE 11 files.

3. Approach and Scope of Work

The Project facilitates controlled flow-through of McCormack-Williamson Tract during high stage combined with a scientific pilot action of breaching a levee to optimize fluvial processes. The southernmost portion of the tract would be open to tidal action. This Project includes the following components. A more detailed description of the components is included in Appendix C. Requested grant funds will, in part, be used for monitoring for compliance with environmental mitigation and permitting requirements and biological monitoring during the planning, implementation, and post-construction operations and maintenance phases (for up to two years after completion of construction). It should be noted that the USACE requires the non-federal sponsor (RD 2110) to provide 100 percent of the operation, maintenance, repair, replacement, and rehabilitation costs of the project after the project is completed for as long as the project is authorized.

Degrade McCormack-Williamson Tract East Levee to Function as a Weir

Extensive hydraulic modeling shows that it is necessary to degrade a portion of the east and southwest levees on McCormack-Williamson Tract to achieve desired flood control benefits in the upper portion of the Project area measured as stage reductions at Benson's Ferry. Because the North Delta study area is limited by channel capacity, and McCormack-Williamson Tract levees are restricted by legal agreement in height, water may overtop the east levee on McCormack-Williamson Tract during large storm events. When the east levee is overtopped, McCormack-Williamson Tract fills and causes the southwest levee to breach catastrophically, causing a surge effect downstream that displaces boats and precipitates further levee failures. Lowering the elevation of the McCormack-Williamson Tract levees would allow flow to move through the tract in a controlled manner, eliminating this surge effect. To convey high river stages into McCormack-Williamson Tract, the degraded east levee would be reinforced as a hardened weir to direct flow and minimize erosion.

Completely Degrade McCormack-Williamson Tract Southwest Levee to Match the Elevation of the Island Floor

The southwest levee of McCormack-Williamson Tract would be lowered to allow floodflows to pass out of the tract without causing a surge effect. To convey high river stages out of McCormack-Williamson Tract, the degraded southwest levee would either be reinforced as a hardened weir to direct flow and minimize erosion or completely degraded to match the elevation of the island floor. During low-flow seasons, the lowered southwest levee would allow tidal exchange on the island from the south.

Reinforce Dead Horse Island East Levee

Because of increased lateral flows and higher velocities from water flowing through McCormack- Williamson Tract, the riverside face of the eastern levee on Dead Horse Island may require additional erosion protection. This levee is located along the eastern edge of Dead Horse Island, directly across Dead Horse Cut from the southwestern end of McCormack-Williamson Tract. The entire Dead Horse Island east levee (approximately 3,000 feet) is currently protected with RSP.

Construct Transmission Tower Protective Levee and Access Road

Construction of a protective levee would be needed to maintain the current level of flood protection for the property being leased by KCRA-3. All alternatives are required to maintain the current level of flood protection and road access with no additional flood risk for the property being leased. The levee would protect the transmission tower and associated control building. Degrading the McCormack-Williamson east levee would necessitate constructing a new access road to the transmission tower. The transmission tower protective levee would be constructed in the northwest corner of McCormack-Williamson Tract. The access road would be constructed along the degraded portion of the east levee on

McCormack-Williamson Tract.

Modify Downstream Levees to Accommodate Potentially Increased Flows

To address the hydraulic effects of opening McCormack-Williamson Tract to more frequent inundation and flow, downstream levees would be raised as needed on the North Fork Mokelumne River to maintain freeboard. Specifically, 40,000 feet of the Staten Island levee would be raised up to three inches along the southern stretch of the North Fork of the Mokelumne River Levees on opposite sides of the waterway in parallel (i.e., matching) profile.

Modify Landform and Restore Agricultural Land to Habitat

The cultivation of agricultural crops on McCormack-Williamson Tract would be discontinued, and the land would be restored to native vegetation types for wildlife habitat. Restoration activities would include modifying the landform to ensure positive drainage and minimize the potential for fish-stranding.

Demolish Farm Residence and Infrastructure

A multi-family farmworker residence (the two-story, wood-frame type commonly used for housing migrant farmworkers) and associated farm outbuildings (sheds) would be removed to allow water to flow unimpeded through the tract, to prevent the structures from being dislodged during high flows, and to complement restoration of the tract to habitat.

Breach the Mokelumne River Levee

The Mokelumne River levee in the northwestern portion of the McCormack-Williamson Tract would be breached to allow a secondary channel of the Mokelumne River to meander through the tract and establish hydraulic connectivity between the breach and the southwestern end of McCormack-Williamson Tract. A starter channel would be excavated to facilitate channel-forming processes in the interior of the tract. Breaching of the Mokelumne River levee and associated ecosystem restoration features to allow for tidal influences in the northern portion of the island and reduce fish strandings in the southern portion of the Tract.

Construct a Cross-Levee

A cross-levee would be constructed across McCormack-Williamson Tract to isolate the bottom third of the island for a subsidence-reversal demonstration project. This levee would allow bi-directional flow during small to large flood events in the winter months but would prevent any tidal action on the upper two-thirds of the island during the dry months. Thus, during low flow, the tract could be drained and operated as two distinct hydrologic cells. The resulting cross-levee would be approximately 3,000 feet long.

The location, objectives, design and construction, and operations and maintenance specific to each Project component are described as follows. Figures 3 through 5 provide specific locations of project components.

4. Deliverables

- Continue updating http://www.water.ca.gov/floodmgmt/dsmo/sab/ndp/index.cfm
- Compliance with the Mitigation, Monitoring, and Reporting Plan
- Subsequent CEQA documentation (for any project components not covered by the North Delta EIR)
- Adaptive Management Plan Studies and Reports
- Final Report on Project (post-construction monitoring for up to two years)

5. Feasibility

Implementation Schedule

Specific construction scheduling will be developed by the US Army Corps of Engineers working in partnership with RD 2110. The construction schedule will be guided by environmental regulatory considerations, weather, soil moisture content, levee construction standards, established work windows, and availability of funding sources, for project components. A detailed construction schedule has not yet been developed based on these constraints, but the project is anticipated to likely occur between June 2011 and December 2017. Section 7, Project Budget, includes a proposed schedule by task.

Construction is likely to be completed over three construction seasons, with the first possible season in 2012. Most construction would be conducted during weekdays between the hours of 7 a.m. and 6 p.m.; however, work on key public infrastructure (such as roadways) and other schedule-sensitive elements may necessitate extended working hours 32 and

work on weekends.

This preliminary operations and maintenance is derived from the Project Description in the North Delta Flood Control and Ecosystem Restoration Project Draft EIR Project Description) (Volume 1, Chapter 2). A final and more detailed Operations and Maintenance Plan will be completed as part of the Feasibility Study for the McCormack-Williamson Tract under the USACE Project Management Plan (PMP).

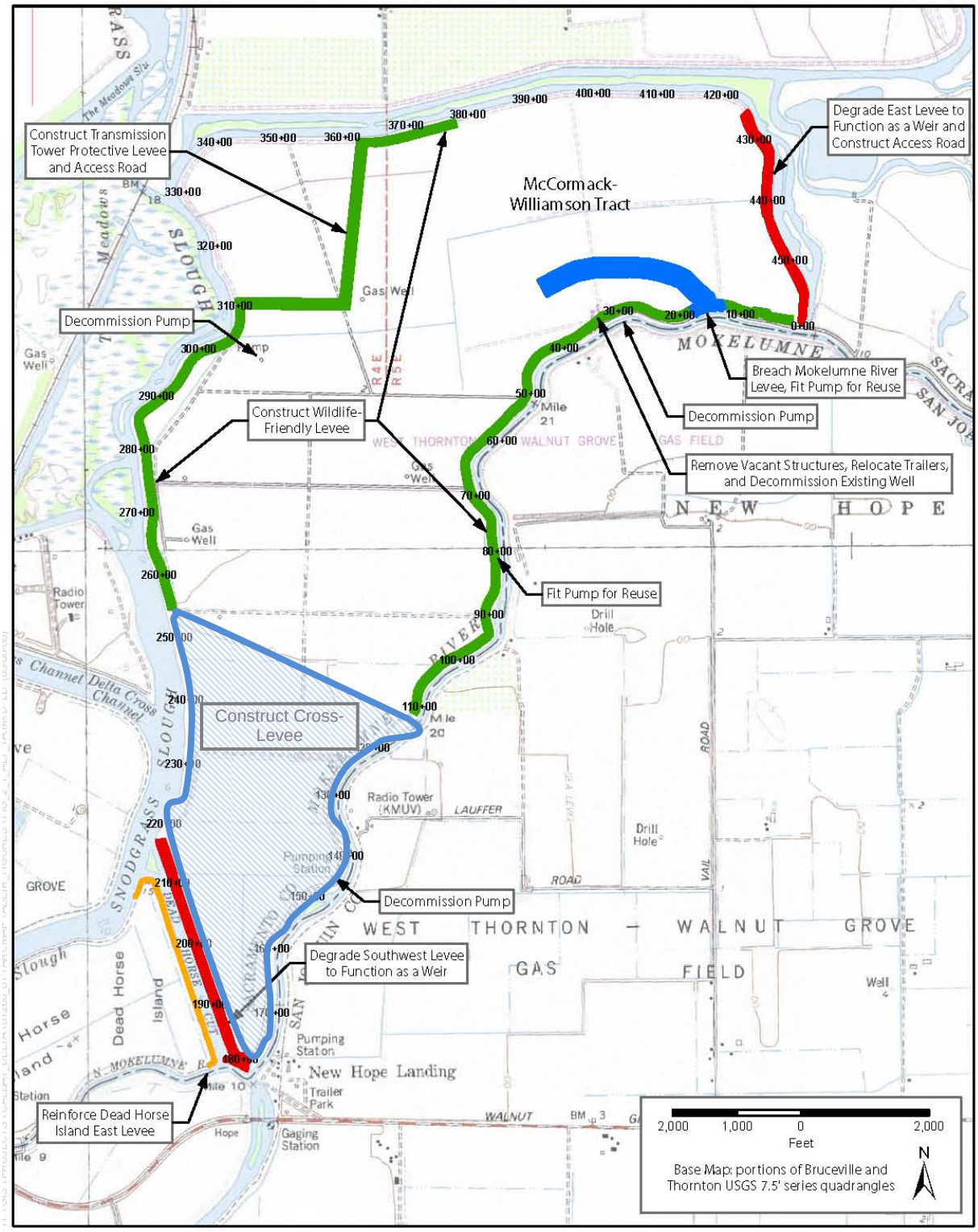


Figure 3: Project Components - McCormack-Williamson Tract

Source: DWR 2010

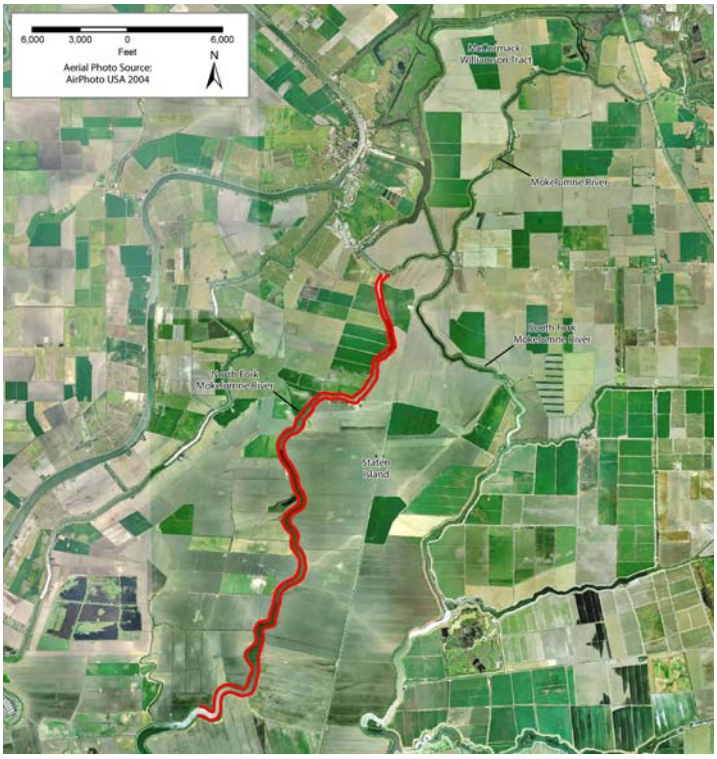


Figure 4: Project Components – North Fork Mokelumne River Levee Modification Plan

Source: DWR 2010

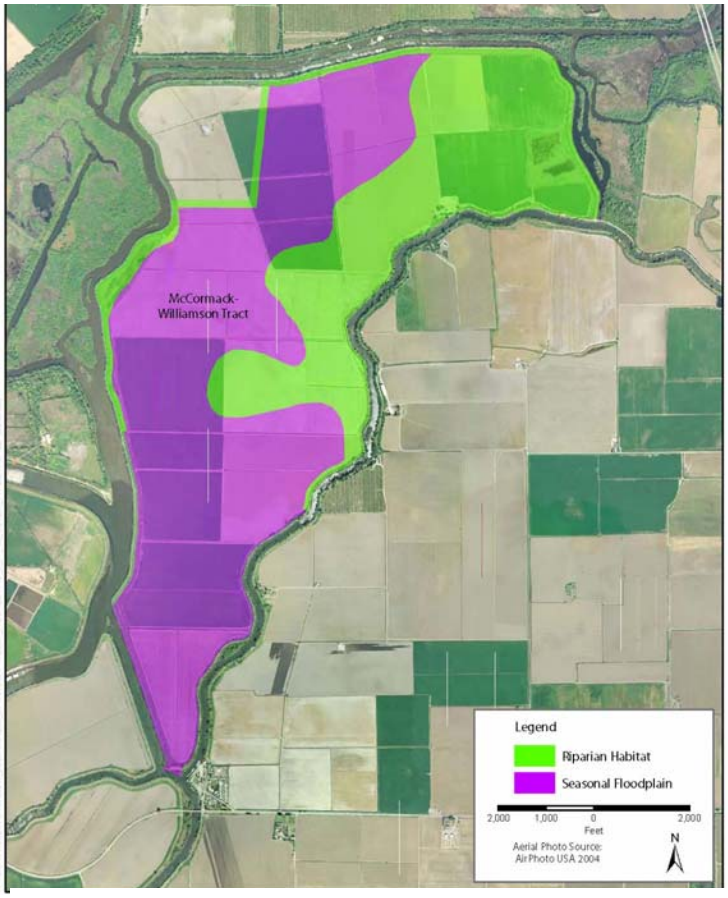


Figure 5: Anticipated Land Cover Types – McCormack-Williamson Tract

Source: DWR 2010

CEQA/NEPA Process

To satisfy CEQA, the Draft EIR for the North Delta Flood Project was released for public comment in November 2007 for a 60 day review period (see, "North Delta Flood Control and Ecosystem Restoration Project," for more information). DWR certified the EIR and adopted a Statement of Findings, Statement of Overriding Considerations, and a Mitigation, Monitoring, and Reporting Program in November 2010.

RD 2110, in consultation with, USACE will also complete either an combined Initial Study / Mitigated Negative Declaration + Environmental Assessment or a combined Environmental Impact Report / Environmental Impact Statement to comply with CEQA and NEPA requirements for Project work to be completed. It is anticipated that additional CEQA / NEPA documentation could tier from the North Delta EIR.

Existing funding

In recognition of the socio-economic and environmental importance of the Delta and the serious threat of levee failures with disastrous and wide-spread consequences, Congress passed the Water Supply, Reliability and Environmental Improvement Act, Public Law (PL) 108-361 ("CALFED Bay-Delta Authorization Act of 2004"). This Act provided for Corps participation in the CALFED Program by authorizing the Secretary of the Army to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality objectives. In May 2006, the Corps submitted the "CALFED Levee Stability Program Report to Congress", which satisfied the CALFED Bay-Delta Authorization Act requirement to submit a report to Congress that describes the levee stability reconstruction projects and priorities that were to be carried out under the program within the Delta. This report was prepared with non-Federal input and support and identified 54 projects totaling more than $1 billion in estimated costs. One of the submissions to the USACE for consideration under this program was the proposed McCormack-Williamson tract project.

The first step in Army Corps process is development of a federal Project Implementation Report by the Army Corps. The PIR includes project plan design, evaluation, analyses of environmental and economic benefits, engineering, cost estimates, environmental impact assessment, real estate requirements and development of a document meeting National Environmental Policy Act requirements. The Army Corps finances the first $100,000 towards completion of the PIR and funds 50% of the remaining costs, with the non-federal sponsor being responsible to fund the other 50%.

RD 2110 has been identified as the non-federal sponsor for the PIR phase of the project. Because the Project benefits are consistent with and help achieve the state's goals for ecosystem restoration, flood control, water supply and water quality, while enhancing levee system integrity in the Delta, the state has agreed to pay 100% of the non-federal cost share for preparation of the PIR, not to exceed $1,280,000. The Project Funding Agreement between RD 2110 and DWR is intended to provide the non-federal cost share for development of the PIR.

Development of the PIR is scheduled to take about 18 months, with completion estimated for the spring/summer of 2012. Based upon the findings of the PIR, as well as financial, economic and conservation factors, the US Army Corps will then decide whether to proceed with the construction phase of the project. If final approval is obtained for this project in 2012, then it is conceivable that construction could begin in 2013. If the Army Corps decides to proceed with construction of the project, a non-federal sponsor must be identified. It will be expected that RD 2110 be the non-federal sponsor for the construction phase of the project, however, there is no legal obligation or commitment to do so until after the PIR is completed.

The estimated project cost is $19.5 million In the design and construction phase, the Army Corps would provide a cost match of 65% ($12.675 million), with 35% coming from the non-federal sponsor ($6.825 million). DWR has agreed to provide the non-federal sponsor with 80% of the non-federal sponsor's costs share ($5,46 million) so the non-federal sponsor will only need to provide the remaining 20% ($1.365 million), or 7% of the total project cost. This proposal solicitation package would be used to cover the 7% cost share for project design and construction ($1.365 million). In addition, this application seeks $1.95 million (10% of project design and construction cost) for pre and post project monitoring. There will also be administrative and contingency costs associated with the project. **Therefore, the total project cost is estimated to be $21,782,200.**

Management team

The DWR has recently re-established their partnership with the USACE, TNC, and RD 2110 to implement flood protection and restoration actions proposed for McCormack-Williamson Tract. The USACE is currently completing a feasibility report for the project (referred to as the preliminary draft Project Implementation Report [PIR]) as part of the CALFED Levee Stability Program. Once the feasibility report is completed, the Corps will develop a Project Management Plan (PMP) which will lay out the scope, schedule, and budget to complete the PIR. The Corps will then enter into a cost-share agreement with the local project sponsor, RD 2110 to finalize the PIR. Management of the project will occur through cooperative agreements between these same entities (RD 2110, TNC, and USACE) as part of the cost-sharing, program

management, and implementation of the project work. As the grantee, RD 2110 will be responsible for meeting grant conditions and grant management. However, RD 2110 will contract with TNC to provide administrative staff. RD will contract with the USACE to implement the PMP and, ultimately manage and construct the proposed project. In turn, USACE will use qualified subcontractors to perform studies, prepare environmental documents, monitor compliance with environmental mitigation measures, prepare final designs for bidding the project work, construct portions of the project, and other specified tasks. Subcontractors will be selected and supervised according the requirements of the PMP and terms of subcontracts to be executed to implement the project.RD2110 will contract with TNC, UC Davis, and likely other state and federal resource agencies to develop a monitoring program for pre and post project monitoring and a focused research plan.

6. Relevance to the CALFED ERP

Relevance to this PSP

Priority 1 of the ERP PSP is “Restoration Projects that Restore or Enhance Aquatic Habitat in the Sacramento-San Joaquin Delta and Suisun Marsh and Bay.” Specifically, desirable projects are considered to provide the following:

- Floodplain restoration to optimize salmon rearing and splittail spawning and rearing functions.
- Intertidal restoration to estuarine productivity, provide spawning and rearing habitat for native fishes using the Delta, and which accommodate long-term habitat changes resulting from climate change.
- Restore geomorphic processes and riparian vegetation and assess aquatic invertebrate production and the resulting effects on fish survival and growth.
- Assessing flora and fauna response to restoration; determining changes in productivity, and monitoring hydrology and geomorphic changes in restored areas.

The overall intent of the McCormack-Williamson Tract Project is based upon the following CALFED Ecosystem Restoration Project objectives:

1. Promote natural flooding processes, tidal action and appropriate salinity regime.
2. Improve river floodplain connectivity.
3. Allow channel migration where practicable.
4. Promote sediment deposition, especially to increase elevations in areas of subsidence due to agricultural activities.
5. Promote Delta foodweb productivity and water exchange with adjacent channels.
6. Restore self-sustaining habitats including freshwater tidal marsh, seasonal floodplain, and riparian.
7. Support special status species in the area.
8. Limit exotic species establishment to the extent practicable.

These objectives have been further developed for the Project as follows:

a. Promote sedimentation through flooding, riverine, and tidal processes;

b. Promote natural flooding processes;

c. Improve river floodplain connectivity;

d. Allow channel migration;

e. Promote foodweb productivity and water exchange with adjacent channels;

f. Restore freshwater tidal marsh, seasonal floodplain, and riparian habitat;

g. Support special status species; and

h. Limit exotic species establishment.

The McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project is designed to implement flood control improvements that encourage establishment of aquatic and terrestrial habitats, native species, and ecological

processes. As described above, under “Project Objectives,” the Project is intended to restore ecologic, hydrologic, geomorphic, and biologic processes and self-sustaining habitats, including freshwater tidal marsh, seasonal floodplain, riparian, and other wetland habitats. Project implementation will restore and enhance several types of habitat associated with the Bay-Delta ecosystem. These habitat types and acreages are detailed as follows:

- Floodplain: 400 acres
- Riparian: 250 acres
- Scrub-shrub: 100 acres
- Channel aquatic: 200 acres
- Dendritic intertidal: 100 acres
- Shallow-water habitat: 500 acres
- Emergency Marsh: 250 acres
- Mudflat: 50 acres
- Grassland: 150 acres

Floodplain inundation, coupled with the flooding of terrestrial vegetation, would increase the quantity and quality of spawning habitat for native pelagic fish (e.g., splittail, Delta smelt, salmon and steelhead). Benefits to fisheries are hypothesized to include increased floodplain rearing, food availability, and growth rates, as follows:

Floodplain Rearing

The precise area of suitable rearing habitat that would be created as a result of floodplain inundation would depend on various factors, including the area of land inundated, water depths in inundated areas, the occurrence of structural cover during inundation (e.g., vegetation), and the timing and duration of inundation relative to the rearing needs of fish.

While on the floodplain, juvenile Chinook salmon exhibit a wide variety of habitat preferences. Based on studies in the Yolo Bypass, juvenile Chinook salmon have been found to be most numerous in low-velocity refugia in association with flooded trees, shoals, and the downstream portions of levees (Sommer et al. 2001a). These types of habitats also would be present on McCormack-Williamson Tract as agriculture ceases and land use transitions to a more natural floodplain community. A major benefit of floodplain habitat is that it provides proportionally much more shoreline habitat than adjacent river channels in the form of internal levee structures, broad shoals, and flooded riparian patches (Sommer et al 2001a). In addition to Chinook salmon, other pelagic, native species, including splittail and delta smelt, would be expected to benefit from the creation of tidal shallow-water and floodplain habitat. For example, in the nearby Cosumnes River, juvenile splittail have been observed to rear on the newly created floodplain before emigrating to adjacent river channels and the estuary as floodwaters recede (Sommer et al. 2001a).

Relative to historical extent, existing shallow vegetated areas in the Delta are limited. Therefore, the creation of additional shallow vegetated areas that may represent habitat for juvenile Chinook salmon, splittail, and delta smelt would be expected to create a beneficial effect for these species.

Food Availability

Restoration of floodplain habitats would create excellent feeding opportunities for several juvenile species in the North Delta. (Sommer et al. 2001b) reported that juvenile Chinook salmon rearing on the Yolo Bypass floodplain had higher growth rates than juvenile Chinook salmon that remained in adjacent river channels. Higher growth rates resulted from increased water temperatures and high prey consumption. The study found that juvenile Chinook salmon consumed significantly more prey items than in-river salmon, and were subsequently able to meet the higher metabolic demands associated with the higher water temperatures found there.

Floodplains in the Central Valley are recognized as being the dominant source of organic carbon for the estuary in wet years (Jassby et al. 1995 as reported in Sommer et al. 2001b). The biomass of phytoplankton, a high quality source of organic carbon for the estuary’s food web, often increases in response to floodplain inundation, presumably in response to increased shallow-water area, increased residence time of water, and warmer water temperature in the floodplain (Sommer et al. 2001b). Phytoplankton are responsible for most of the primary production in the estuary, and their biomass in the estuary has experienced a long-term decline, presumably in response to grazing by introduced bivalves, water exports and low outflow, and climate change (Sommer et al. 2001b).

Floodplain systems can also be an important source of primary productivity. Although it is difficult to predict how much additional organic carbon will be available from inundation of additional floodplain area, any increase in primary production resulting from floodplain inundation is considered to be a benefit to the North Delta ecosystem. Studies form the

Cosumnes River indicate that periodic connection and disconnection of the floodplain can provide downstream aquatic ecosystems with a source of concentrated algal biomass (Ahearn et al. 2006). Increases in primary productivity can lead to increased fish production through greater food availability.

Growth Rates

Habitat conditions during floodplain inundation can result in increased growth rates for fish as a result of higher water temperatures and greater abundance of quality food items (such as dipteran larvae). The combination of warmer water temperatures and increase food availability results in increased feeding success for young fish (Sommer et al. 2001a). Studies show the juvenile Chinook salmon rearing on the Yolo Bypass floodplain had higher growth rates than juvenile Chinook salmon that remained in adjacent river channels (Sommer et al. 2001a). The study also found that juvenile Chinook salmon on the floodplain consumed significantly more prey items and benefited from the warmer water temperatures found on the floodplain. Although this research focused on Chinook salmon, it is expected that other species such as splittail and Delta smelt may benefit in similar ways. Increased growth rates for fish in floodplain habitats are believed to be the result of the occurrence of extensive shallow, low-velocity areas combined with abundant prey resources and reduced energy expenditures (Sommer et al 2005: 1500). Increased growth rates in fish can improve juvenile survival by reducing their vulnerability to predation and through an improvement in condition factor (i.e., fitness).

Priority 2 of the ERP PSP is "Research that Tests Hypothesis Identified in the DRERIP Evaluation of the BDCP Conservation Measures and National Research Council OCAP Biological Opinion Review and Address Uncertainties." The identified research needs are grouped and shown in **bold font,** followed by a discussion of how the Project addresses the research area.

- **Continue to study tidal marsh restoration efforts in the Delta and Suisun Marsh to determine how much this can supplement pelagic fish production.**
- **Determine the ecological characteristics of shallow water habitat in the Delta that are beneficial for native species and less likely to support non-native species.**
- **Develop temporal regimes for water movement that minimizes adverse effects on fisheries.**

Implementation of the Project will restore tidal freshwater wetlands and associated habitat on the McCormack-Williamson tract. This will allow for research opportunities to determine the appropriate frequency of flooding that will lead to ecosystem restoration, studies pertaining to flooding tidal processes interactions, and how riparian and grassland habitat develop over time.

Under current conditions, aquatic habitats in channels adjacent to project features generally provide limited value due to past and ongoing flood protection activities that have resulted in removal of riparian vegetation communities and associated habitat functions. The areas with the highest habitat values include the Mokelumne River and Snodgrass Slough adjacent to McCormack-Williamsons Tract, especially the upstream segments. As a result, channels in the study area primarily serve as migration corridors with some limited rearing (juvenile Chinook salmon, steelhead, Delta smelt, splittail, and possible green sturgeon) and spawning (delta smelt, striped bass, and splittail) habitat functions for species of management concern. Project implementation would substantially benefit these species through increased habitats for floodplain rearing, food availability, and growth rates, as described above, under Priority 1, and briefly reiterated below.

Floodplain Rearing: Relative to historical extent, existing shallow vegetated areas in the Delta are limited. Therefore, the creation of additional shallow vegetated areas that may represent habitat for juvenile Chinook salmon, splittail, and Delta smelt would be expected to create a beneficial effect for these species.

Food Availability: Floodplain systems can also be an important source of primary productivity. Although it is difficult to predict how much additional organic carbon will be available from inundation of additional floodplain area, any increase in primary production resulting from floodplain inundation is considered to be a benefit to the North Delta ecosystem. Studies form the Cosumnes River indicate that periodic connection and disconnection of the floodplain can provide downstream aquatic ecosystems with a source of concentrated algal biomass (Ahearn et al. 2006). Increases in primary productivity can lead to increased fish production through greater food availability.

Growth Rates: Increased growth rates in fish can improve juvenile survival by reducing their vulnerability to predation and through an improvement in condition factor (i.e., fitness).

- **Conduct research to determine scale and balance of flow, sediment, and organic material inputs needed to restore riverine ecosystem function.**
- **Evaluate physical and geomorphic processes and monitor connectivity and key ecological variables to assess effects of seasonal and annual hydrologic variability.**
- **Address potential factors affecting productivity (e.g., contaminants).**

Because the McCormack-Williamson Tract is located within the Cosumnes River Management Plan area, it is subject to goals, objectives, action, and monitoring discussed in the management plan. This approach is called “Conservation Action Planning” (CAP). CAP was applied to the Preserve and its surrounding lands in order to identify biological targets for conservation, assess ecological requirements for long-term viability of these targets, identify threats, and develop specific strategies to restore target viability and reduce threats.

Several conservation targets were identified for the Cosumnes River Preserve. Conservation targets are species, communities, or ecological systems that represent the biological diversity of a specified area. Ideally, targets are elements of the system that, if properly conserved, will result in the conservation of the full diversity of the landscape. Coarse-filter targets serve as “umbrellas” that targets include those small-scale biodiversity, both common and rare, that tier within them. Fine-filter targets include those small-scale elements that “fall through” the coarse filter and require individual attention.

Six targets have been identified: riparian forest, vernal pool grasslands, freshwater emergent wetlands, giant garter snake, blue oak woodland, and fall-run Chinook salmon. An assessment of each target, including a conceptual model, was prepared. Ecological requirement were identified for a range of attributes, such as viable habitat area, population size, community structure, species composition, hydrologic regime, disturbance processes, landscape connectivity, and others. Acreage goals for protection and restoration of each target were based on the current extent of habitat (land-cover mapping) and the inferred potential or historic habitat (based on location of appropriate soils, hydrology, and topography).

To address potential factors affecting productivity, the CAP process includes identification of critical threats that would reduce the viability of conservation targets.

- Continuing fragmentation and degradation of habitat (both natural and surrogate agricultural lands) will erode ecological function of the larger landscape by isolating populations, disrupting species movements, altering ecosystem processes, increasing edge effects, and decreasing species richness (*e.g.*, Hansen *et al.* 2005; McArthur and Wilson 1967). Urbanization and other forms of land development are the primary cause of habitat fragmentation and direct loss of habitat area.
- Depletion of groundwater has reduced stream base flow.
- Land conversion to more intensive, less wildlife-friendly agriculture.
- Invasive species.
- Levees that limit river meandering and floodplain connectivity.
- Altered flooding regimes that affect riparian forest.
- Altered fire regimes that affect vernal pool grasslands and oak woodlands.

In addition, the Project’s Adaptive Management Plan is geared toward on-going research and evaluation of the Delta ecosystem. Among the various topics included in this plan, specific criteria for the scale and balance of flow, sediment, and organic material inputs; physical and geomorphic processes; and factors affecting productivity. Preliminary success criteria are included as follows:

- Appropriate frequency of flooding to achieve multiple ecosystem restoration objectives.
- Appropriate flood plain area to achieve multiple ecosystem restoration objectives
- Scour and deposition are occurring at the site at an acceptable rate without damaging wildlife-friendly levees, etc.
- Flooding and tidal processes are compatible (e.g., flooding does not destroy formation of tidal channels or conversely filling of the McCormack-Williamson Tract with water from tidal processes does not inhibit riverine processes’).
- Sedimentation is occurring but not at rates that are higher than expected in secondary channel.
- Mercury methylation on floodplain is insignificant and not affected by hydrology.
- Mercury methylation does not vary by area of floodplain (water depth) during times when floodplain is flooded

These criteria will be evaluated and reflected in future operations and maintenance activities (i.e., adaptive management responses) associated with the project. These adaptive management responses may include:

- Adjustment in height of east levee and/or inflatable dam by raising to increase frequency water shunted to Mokelumne River breach or lowering to increase frequency McCormack-Williamson Tract floods over east levee.
- Changing factors that affect hydrology (east levee height, channel configuration), if floodplain area is too small or too large.

- Changing factors that affect hydrology (east levee height, channel configuration) to increase hydraulic energy, if scour and deposition are not occurring; or if scour and deposition are occurring too violently (such that the wildlife-friendly levees are threatened, for example), change factors that affect hydrology to lessen hydraulic energy or put in erosion protection.
- In the case that flooding and tidal processes are incompatible (e.g., flooding destroys formation of tidal channels that are not reformed for many years, or conversely filling of the McCormack-Williamson Tract with water from tidal processes inhibits riverine processes), decide whether to preserve flooding (and raise southern levee to height inhibiting tidal action) or preserve tidal processes and inhibit flooding by raising east levee or closing off secondary channel.
- If sedimentation rates are higher than expected in secondary channel, determine if it is still functioning to bring water onto the floodplain. If not, consider excavating channel further into the McCormack-Williamson Tract. If sedimentation is occurring in the northern portion of the McCormack-Williamson Tract, consider strategies (such as hydrologic changes or physical transfer) to transfer sediment to the southern portion of the McCormack-Williamson Tract.
- If mercury methylation on the floodplain is significant and affected by hydrology (east levee height or secondary channel dimensions), adjust factors that affect hydrology. For instance, consider eliminating habitat by raising east levee or closing Mokelumne River breach that forms secondary channel.
- If mercury methylation in dendritic intertidal wetlands is significant and affected by hydrology, adjust factors that affect hydrology (e.g., adjust levee heights).
- If mercury methylation in subtidal areas is significant and affected by hydrology, change factors that affect hydrology (e.g., adjust levee heights).

- **Test the "Variable Delta" hypothesis to see if manipulating salinity and flows can help control invasive aquatic species and to see how native species use or avoid these conditions.**
- **Control introduced species and examines their effect on food web dynamics.**

Degradation and the loss of habitats that support various life stages of aquatic and terrestrial species are a primary concern in the North Delta. These habitat changes come from many causes, including sedimentation from hydraulic mining, habitat conversion, water diversions, and the introduction of exotic species. The Project would reform the interior of McCormack-Williamson Tract and facilitate conditions for natural revegetation.

To assist these processes and facilitate habitat benefit, minor grading would occur to ensure positive drainage and provide more diverse geomorphic surfaces. It is intended that a dendritic channel network would provide a maximum amount of edge habitat for native fish as well as provide positive draining of the tract after high-flow events to avoid fish-stranding. The channels would be located within the intertidal zone and would dry out on a daily basis, preventing the establishment of exotic submerged aquatic vegetation.

To reduce risk and minimize potential for colonization by exotic vegetation species, native and non-invasive starter vegetation would be planted, such as tule in the wetter southern portion of the island and grasses in the drier northern part. Over time, it is anticipated the flooding events would import propagules such as willows, cottonwoods, and perennial herbs that would naturally colonize on higher areas and tules and other water plants at intertidal and subtidal elevations.

The Project's Adaptive Management Plan, described above under, "Hypotheses Testing." provides a series of questions, hypotheses, research opportunities that address specific issues related to topics discussed above.

Priority 3 of the ERP PSP is, "Projects using Constructed Facilities to Control Mercury or other Mine Drainage in the Bay-Delta or Dissolved Oxygen and Other Water Quality Problems in the Lower San Joaquin River and South Delta." As described in the 2010/2011 PSP this goal is intended:

> [t]o meet water quality goals and standards in the Delta for mercury and dissolved oxygen and to reduce mobilization of mercury into the foodweb or into the Delta[. T]here is a need for projects that implement and evaluate best management practices for reducing loads of these constituents to the Delta.

Implementation of the Project would substantially change land practices on approximately one-half of McCormack-Williamson Tract. The southernmost portion of the tract would be converted to open-water, subtidal habitat, and an adjacent portion of the tract would be converted to intertidal marsh. The tidal wetlands of McCormack-Williamson Tract would produce environments that may increase the release of methylmercury. However, adoption of Alternative 1-A in the North Delta Flood Control and Ecosystem Restoration Project (i.e., the McCormack-Williamson Tract Flood Control and Ecosystem Restoration Project), includes Mitigation Measure WQ-1, "Participate in an Offset Program to Ensure No Net

Increase in Methylmercury Loading." This mitigation measures requires implementation of feasible BMPs that are developed as part of the Sacramento-San Joaquin Delta Estuary TMDL for Methyl and Total Mercury. If no feasible BMPs are identified in the TMDL implementation plan, DWR will participate in an offset program to ensure no net increase in methylmercury loading into the Delta as a result of Project implementation. This would require quantification of the increase in methylmercury from the land conversion of the Project, and could include participating in funding improvements to the Cache Creek Settling Basin, other projects as recommended by the Central Valley RWQCB, or purchasing credits in an existing, approved offset program.

While reduction of mercury mobilization is not an anticipated effect of the Project, the Project includes research programs and hypotheses designed to address issues related to dissolved organic carbon and methylmercury. This is discussed further above in, "Hypotheses Testing."

Relevance to CALFED Issues Outside this PSP

The ERP Stage 2 Conservation Strategy for the Sacramento-San Joaquin Delta Ecological Management Zone (Delta EMZ) document (ERP Stage 2 Conservation Strategy) became available on July 21, 2010 (DFG, USFWS, and NOAA 2010). The ERP Stage 2 Conservation Strategy describes ecosystem restoration goals, objectives, and priorities for the Delta EMZ.

Habitat features that will be facilitated in the Project site are outlined in Action 3, for Floodplains: "Continues implementing projects at the Cosumnes River Preserve, such as restoring active and regular flooding regimes and flood riparian forest habitat; measuring flora and fauna response to restoration; and monitoring surface and groundwater hydrology and geomorphic changes in restored areas." The Project site is located with the East Delta Ecological Management Unit (EMU) priority zone, which is described as follows:

East Delta EMU.

- *Cosumnes-Mokelumne Confluence.* Create a mosaic of seasonal floodplain, riparian, shallow subtidal, and tidal marsh areas. The confluence of the Cosumnes and Mokelumne river systems has been an area of extensive property acquisitions (Cosumnes River Preserve), and continues to be an important area for restoring floodplains and seasonal wetlands. In the near term, ERP plans to restore acquired properties (e.g., McCormack-Williamson Tract). In addition, areas north and south of the Cosumnes-Mokelumne confluence are at land elevation, which would accommodate tidal marsh and shallow subtidal areas.
- Acquisition of lands at the eastern periphery of the Delta EMA, could be restored to shallow subtidal and tidal marsh areas in the future as a sea level rises, will also be pursued in the near term; however, restoration of these properties (many of which are currently in private ownership) may not become a high priority unless and until a new water supply conveyance facility is in place.

The ERP Stage 2 Conservation Strategy clearly states that there are uncertainties related to the function of the Delta Ecosystem. Because of this uncertainty an Adaptive Management Process was framed that included numerous assessments and pathways for responses. As described above, under, "Hypotheses Testing," the Project's Adaptive Management Plan generally consists of performance measures (i.e., research questions), success criteria (i.e., hypotheses), and adaptive management responses (i.e., potential research opportunities). This approach in inline with the ERP Strategic Plan because it provides analytical tools for conducting scientific evaluations of potential ecosystem restoration actions, and feedback loops to ensure that management decisions are based on the best and most current information. The Adaptive Management Plan provides the basis for many of the ERP Stage 2 Conservation Strategy Actions, as discussed further below.

Implementation of the Project would result in increased areas of tidal marsh habitat. Increased areas of tidal marsh habitat and floodplains are anticipated to support native fish rearing, food availability and growth rates. Action 4 for Tidal Marsh (intertidal areas) could be accomplished upon project implementation to examine if freshwater portions of the estuary provide fish benefits as demonstrated in saline portions of the estuary. While not part of Project implementation, research contributing to the understanding of foodwebs, fish populations, and invasive species could be conducted including those described in:

- **Action 1 for Decline in Productivity and the Aquatic Flood Web**: Determine how to alleviate the negative impacts of non-native species (e.g., *Corbula*) and contaminant toxicity on the pelagic foodweb.
- **Action 2 for Decline in Productivity and the Aquatic Flood Web**: Determine how much tidal marsh restoration efforts in the Delta and Suisun Marsh can supplement pelagic fish production.
- **Action 5 for Non-Native Invasive Species**: Standardize methodology for sampling programs to

measure changes in NIS populations over a specific timeframe.

- **Action 6 for Non-Native Invasive Species**: Collect and analyze water quality sampling data (e.g., salinity and water temperature) for correlation analysis between NIS distribution and habitats.
- **Action 8 for Non-Native Invasive Species**: Establish a program to monitor for new invasions of non-native wildlife, and develop responses to quickly contain and control them.

In addition, the Adaptive Management Plan contains criteria to examine environmental water quality, including dissolved organics, contaminants, and mercury methylization processes in aquatic habitats.

The Project is considered to be suitable for an Adaptive Management Approach because of the complex and inherently unpredictable nature of ecosystems. DWR staff, with the assistance of scientific experts and participating agencies, developed several conceptual models to address uncertainties associated Project implementation. Scientific input was heavily relied upon to develop the Adaptive Management Plan, through the NDSP.

7. Expected Quantitative Results (Project Summary):

Implementation of the Project would restore natural floodplain and flood processes, including backwaters, wetlands, slough, and distributaries that carry and store floodwaters. Specifically, land would consist of approximately 400 acres of floodplain, 200 acres of channel aquatic, 100 acres of dendritic intertidal, 500 acres of shallow-water habitat, 250 acres of emergent marsh, and 50 acres of mudflats. Within the total Project acreage (, 250 acres of riparian habitat and 150 acres of grassland would be restored. Overall. the project would result in the loss of 1,654 acres of agricultural lands (Prime Farmland)..

8. Other Products And Results:

The Project is part of the Cosumnes River Preserve Management Plan. Because implementation of the project includes ecosystem restoration and other benefits to the Preserve, overall, the following public benefits would be realized from implementation of the project.

Recreation

The Preserve currently offers a wide range of wildlife-compatible recreational activities, including wildlife viewing, hiking, boating, canoeing, hunting, fishing, sightseeing, and geocaching. Designated areas of the Preserve are open to the public, including trails and facilities located on parcels owned or managed by the BLM, SMUD, and TNC, as well as along public roads and on the river channel. Recreational opportunities within the Preserve include:

- boating/paddling,
- wildlife viewing,
- hiking,
- fishing,
- geocaching,
- photography,
- rural road sightseeing, and
- hunting.

Research Opportunities

Between the years 2001 and 2006, over 90 researchers representing 18 institutions conducted research at the Preserve. Partnerships with these 18 institutions and other similar institutions are critical to the future success of the Preserve. Given the complexity of managing habitat for the numerous species that occupy the Preserve in an adaptive management context, it is important for the Preserve's scientists and other staff to keep updated on new scientific research and conceptual models. This is best accomplished by maintaining close relationships and partnerships with the research institutions. Additionally, these research institutions conduct research onsite, which increases the level of certainty that the results will be directly applicable to the Preserve's ecosystems.

The UC Davis Center for Watershed Sciences is the most active institution conducting research at the Preserve. The Center obtained grants to support two phases of research, the first of which, called Cosumnes I, focused primarily on the relationship between hydrologic conditions and aquatic ecosystems. The second phase, Cosumnes II, built on this earlier work but emphasized aquatic and terrestrial systems. The results of these studies may be viewed on their website.

This research is applicable to CALFED restoration and watershed monitoring strategies. Research projects are conducted by scientists at various stages of professional development. These include high school students, undergraduates, graduate students, professional scientists, and public agency personnel. Research activities are mostly extramurally funded.

Education and Outreach Programs

The Cosumnes River Preserve has been featured in a State-adopted 4th-grade Social Studies textbook published by National Geographic and featured on several TV and radio programs. Many school districts in the region utilize the Preserve's K–12th Grade Education Program. During the 2005/2006 and 2006/2007 school years, classes from 10 districts, including elementary, middle, and high schools, visited the Preserve. Additionally, several private and home schools participated in Preserve education programs. Most field trips occur during the school day; however an increasing number of after school programs are beginning to utilize the Preserve as a field trip destination.

9. Qualifications

Implementation of the Project will be managed by USACE in collaboration with RD 2110 and The Nature Conservancy, which has experience in managing several restoration and conservation projects. USACE will work closely with RD 2100 to determine the feasibility of various project components. This study will be conducted under a Project Management Plan (PMP) executed between the Corps and RD 2100 (see Appendix D). The PMP sets forth the parameters of the Project components, technical studies to be conducted, and the work plan that precedes project implementation.. For information about other California conservancy projects, go to: www.nature.org/wherewework/northamerica/states/california/preserves/.

10. Literature Cited

Ahearn, D.S, J.H. Viers, J.F. Mount and R.A. Dahlgren. 2006. Priming the productivity pump: Flood pulse driven trends in suspended algal biomass distribution across a restored floodplain. University of California, Davis.

California Department of Fish and Game, U.S., Fish and Wildlife Service, and National Marine Fisheries Service. 2010 (July 21). Ecosystem Restoration Program. Conservation Strategy for Stage 2 Implementation. Sacramento-San Joaquin Delta Ecological Management Zone.

California Department of Water Resources. 2010. North Delta Flood Control and Ecosystem Restoration Project Environmental Impact Report. Prepared by Jones and Stokes. Available: http://www.water.ca.gov/floodmgmt/dsmo/sab/ndp/documents/. Accessed: February 2011.

Central Valley Regional Water Quality Control Board 2005. Sacramento–San Joaquin Delta Estuary TMDL for Methyl & Total Mercury Draft Report.

Cosumnes River Preserve. 2008. Cosumnes River Preserve Management Plan Final. Prepared by Kleinschmidt Associates, Grass Valley, CA.

Jones & Stokes. 2000. Environmental Impact Report, Environmental Impact Statement for the Lower Mokelumne River Restoration Program. May. (J&S 08059.98.) Sacramento, CA. Prepared for: Woodbridge Irrigation District. Cosumnes River Preserve 2008),

Sommer, T., B. Harrell, M. Nobriga, R. Brown, P. Moyle, W. Kimmerer, and L. Schemel. 2001a. California's Yolo Bypass: Evidence that flood control can be compatible with fisheries, wetlands, wildlife, and agriculture. *Fisheries* 26(8):6-16.

Sommer, T.R., M.L. Nobriga, W.C. Harrell, W. Batham, and W.J. Kimmerer. 2001b. Floodplain rearing of juvenile Chinook salmon: Evidence of enhanced growth and survival. *Canadian Journal of Fisheries and Aquatic Sciences* 58(2):325–333.

Sommer, T.R., W.C. Harrell, and M.L. Nobriga. 2005. Habitat use and stranding risk of juvenile Chinook salmon on a seasonal floodplain. North American Journal of Fisheries Management 25:1493-1504.

U.S. Army Corps of Engineers. 1991. Hydraulic Design of Flood Control Channels. EM 1110-2-1601, Washington, DC. Available: <http://www.usace.army.mil/publications/eng-manuals/em1110-2- 1601/toc.htm>. Last Accessed; November 6, 2006.Delta Protection Commission (DPC).

1. Detailed Budget: Overall Project Budget By Task and ERP Program Objective Showing Cost Shares

Task	Cost	RD 2110 Share	Federal Share	State Share	DWR Grant Share	Start	Complete	Project Objectives
1. Project Administration								Flood control • Convey floodflows to the San Joaquin River without immitigable stage impacts. • Reduce the risk of catastrophic levee failures based on the 1997 event for stage and the 1986 event for volume. • Control floodwaters coming through McCormack-Williamson Tract in a way that minimizes the surge effects (i.e., avoids the historical occurrence when a large pulse of water from McCormack-Williamson Tract adversely affected adjacent island levees (e.g., Tyler and Staten Islands) and downstream flows and knocked boats loose from local marina moorings in flood events). Ecosystem Restoration • Implement science-driven pilot programs to restore ecologic, hydrologic, geomorphic, and biologic processes and self-sustaining habitats, including freshwater tidal marsh, seasonal floodplain, riparian, and other wetland habitats. • Support special-status species. • Limit exotic species establishment. • Promote foodweb productivity. • Promote natural flooding processes and tidal action. • Promote processes to increase land surface elevations in areas of subsidence. Recreation • Enhance public recreation opportunities in a manner that does not compromise flood protection infrastructure or operations, comprise habitat integrity, or disturb wildlife.
Contract Administration Services	$ 252,000	$252,000				11-Jun	17-Dec	
Direct Expenses (equipment, supplies, reproduction, travel, communication, etc.)	$ 25,000	$ 25,000				11-Jun	17-Dec	
Legal Fees	$ 25,000	$ 25,000				11-Jun	17-Dec	
Subtotal, Task 1	$ 302,000	$302,000	$ -	$ -	$ -			
2. Planning								
Design, Survey Work, and CEQA/NEPA Compliance	$ 1,205,000		$ 450,000	$ 755,000		11-Jun	13-Jun	
Environmental Permitting	$ 150,000		$ 50,000	$ 100,000		11-Jun	13-Jun	
Subtotal, Task 2	$ 1,355,000	$ -	$ 500,000	$ 855,000	$ -			
3. Implementation								
Construction Management	$ 925,000		$ 473,000	$ 309,000	$ 143,000	13-Jan	15-Dec	
Construction Preparation, Clearance, Staking, Fencing, etc.	$ 1,000,000		$ 500,000	$ 500,000		13-Jan	15-Dec	
Structural Work (levees and other structures)	$ 9,050,000		$ 7,650,000	$ 1,400,000		13-Jun	15-Dec	
Non-Structural Work (including vegetation, planting, irrigation)	$ 5,220,000		$ 2,400,000	$ 1,900,000	$ 920,000	13-Jun	15-Dec	
Subtotal, Task 3	$ 16,195,000	$ -	$ 11,023,000	$ 4,109,000	$ 1,063,000			
4. Monitoring and Post-Construction Management								
Construction Monitoring and Post Construction Management	$ 1,950,000				$ 1,950,000	12-Jun	17-Dec	
Subtotal, Task 4	**$ 1,950,000**	$ -	$ -	$ -	**$ 1,950,000**			
Contingency (10%)	$ 1,980,200	$ 30,200	$ 1,152,300	$ 496,400	$ 301,300	*	*	
Subtotal, Tasks 1-4	**$ 21,782,200**	**$332,200**	**$ 12,675,300**	**$ 5,460,400**	**$ 3,314,300**			
TOTAL	**$ 21,782,200**	**$332,200**	**$ 12,675,300**	**$ 5,460,400**	**$ 3,314,300**			

* Expenditures occur throughout project timeframe

Section 7: Project Budget

1. Budget justification:

The funding requested under the Ecosystem Restoration Program is needed to fill a funding gap that will not be provided by USACE or the State of California. There is no other source of funding readily available to fill this gap (see details above under “Existing Funding.” Please note that it is not possible at this time to provide a budget breakdown by project component (as described in Appendix C) until the USACE completes the Feasibility Study (see Appendix D for the Project Management Plan for the Study).

2. Administrative Overhead:

No administrative overhead is proposed for RD 2110, as USACE will perform most work related to this project, including program and project management.For work not done by USACE, RD 2110 will work with TNC to perform those tasks., therefore

Appendix A: List of Permits

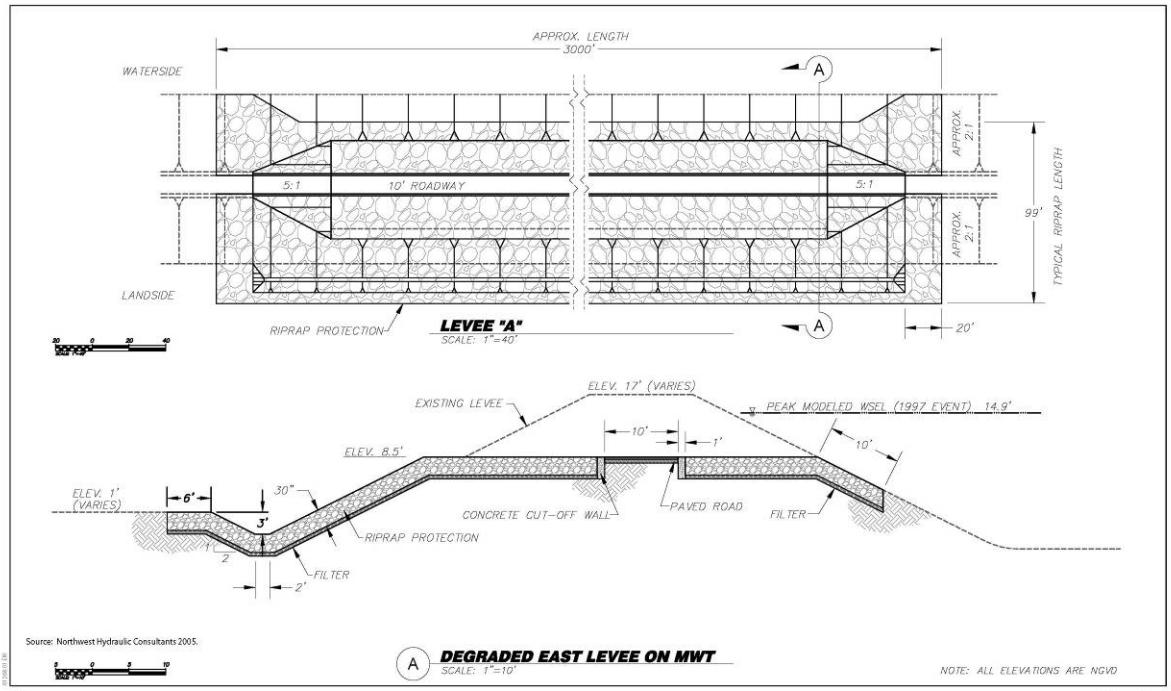
(From the North Delta Flood Control and Ecosystem Restoration Project Mitigation, Monitoring, and Reporting Program)

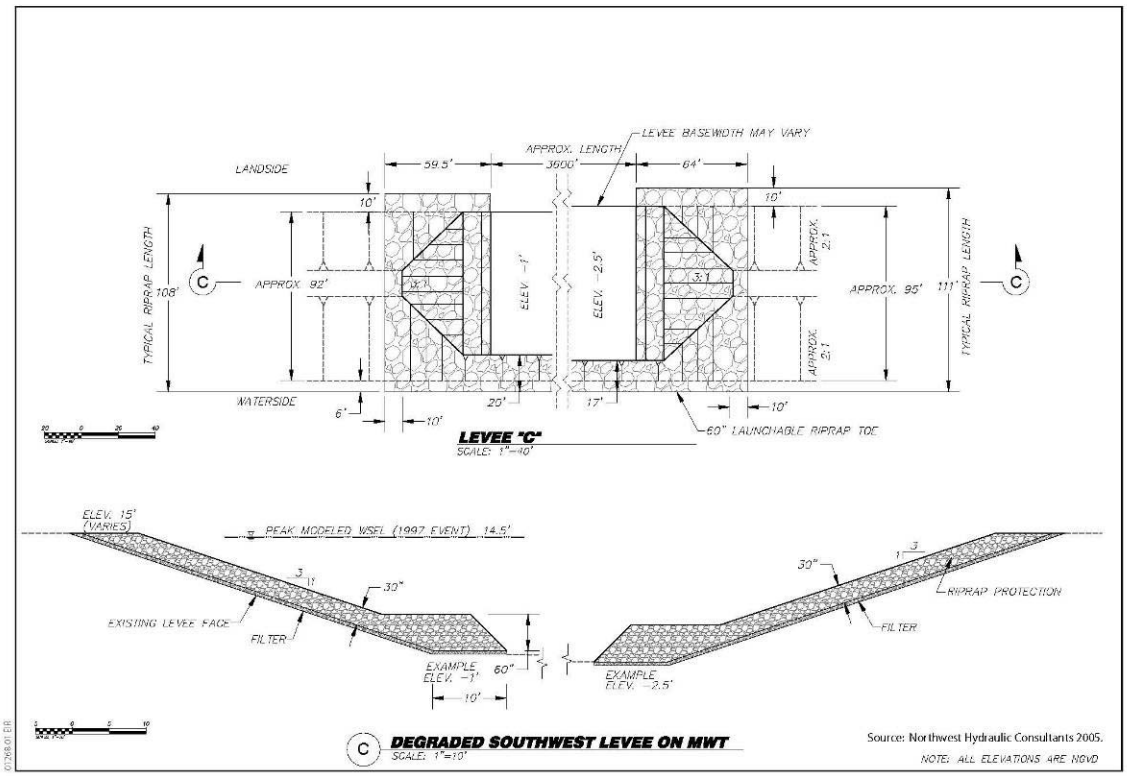
NOTE: The following attachment contains a description of the environmental and other permits needed to implement the proposed project. The attached document is the Mitigation, Monitoring, and Reporting Program from the North Delta Flood Control and Ecosystem Restoration Project EIR. The USACE Feasibility Study will determine the precise nature of permits needs to proceed with the project.

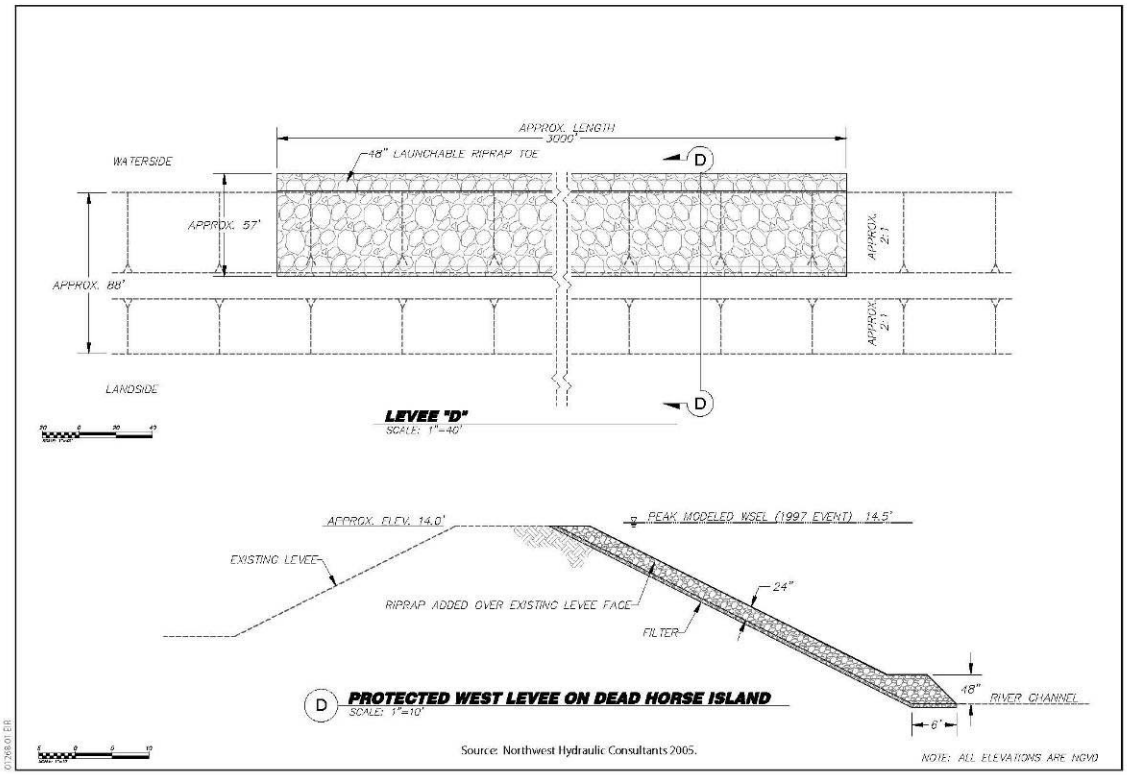
ERP Proposal Application Form

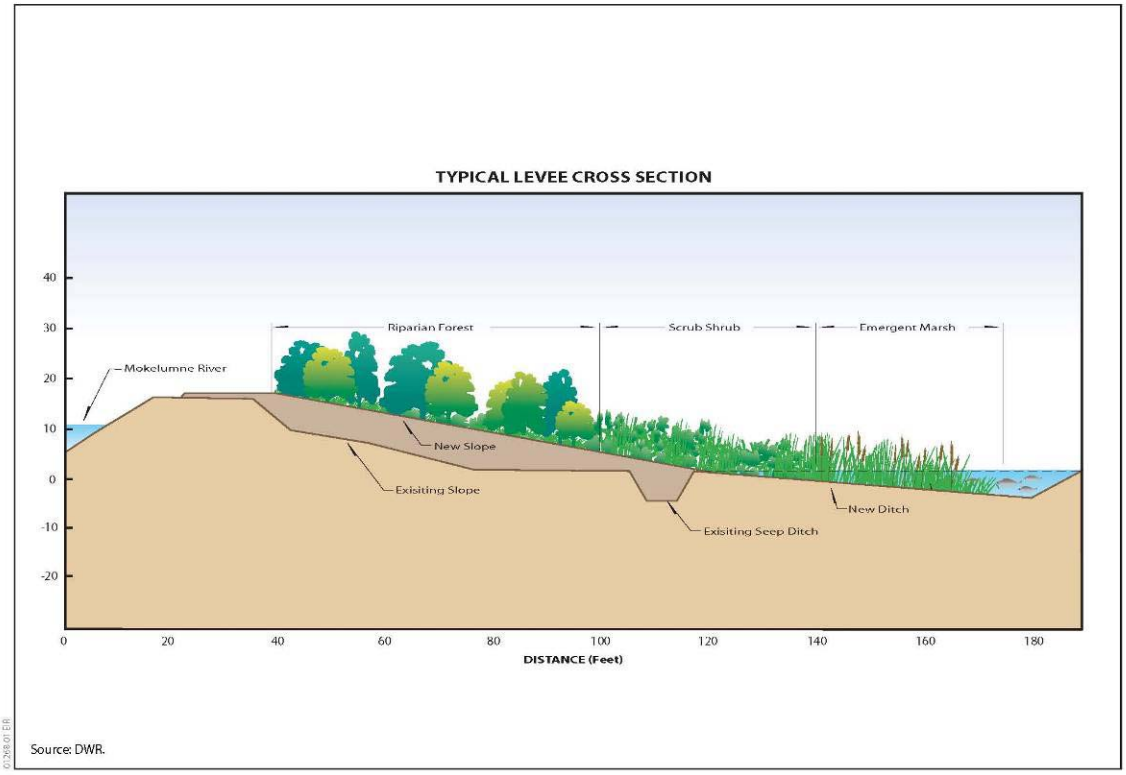
Appendix B: Project Design

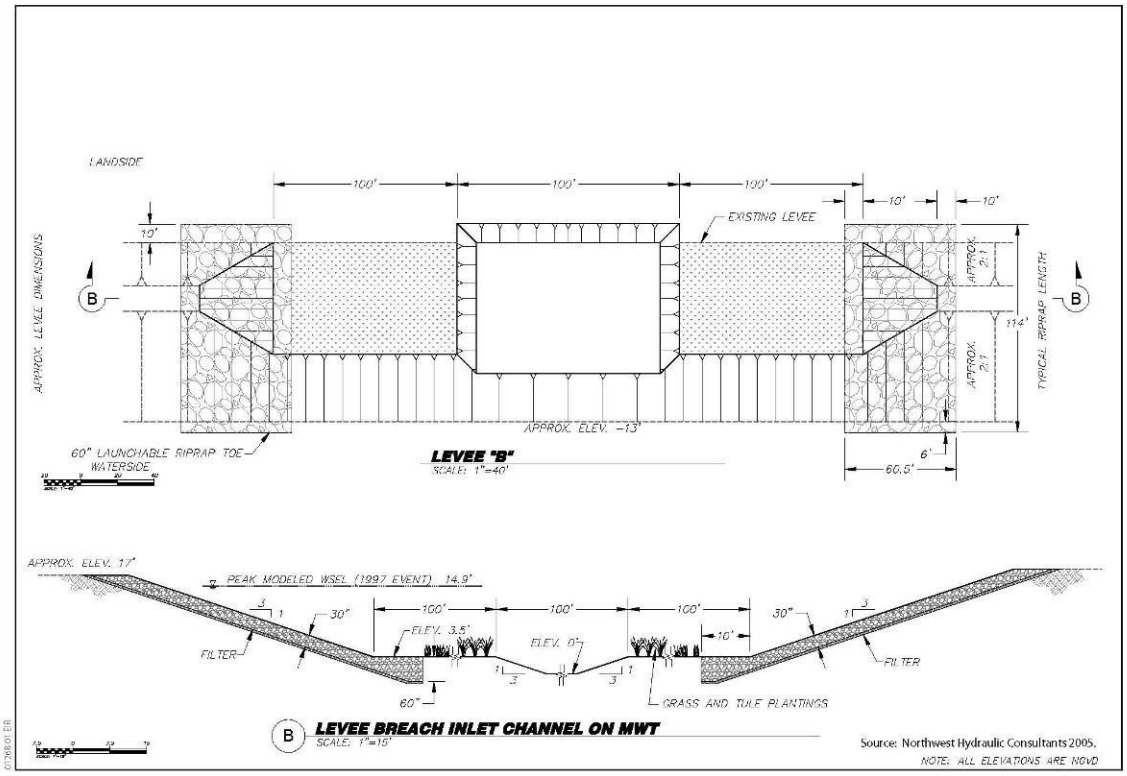
(From the North Delta Flood Control and Ecosystem Restoration Project EIR, Volume 2)

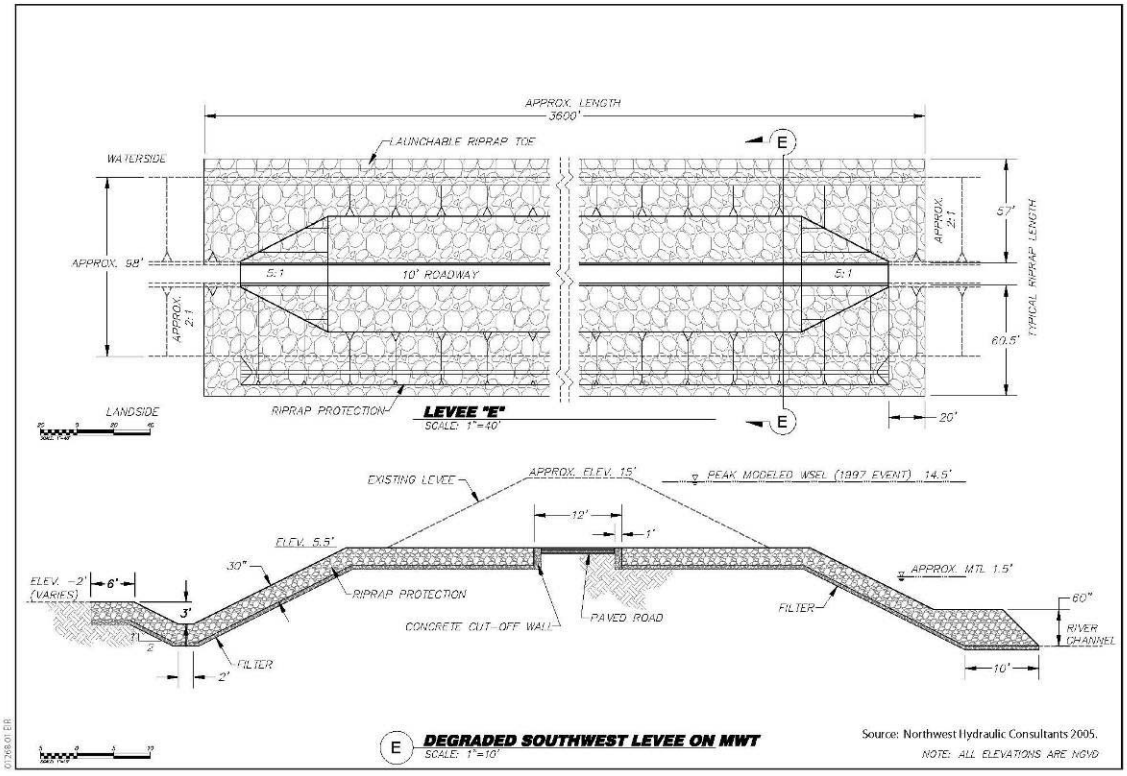


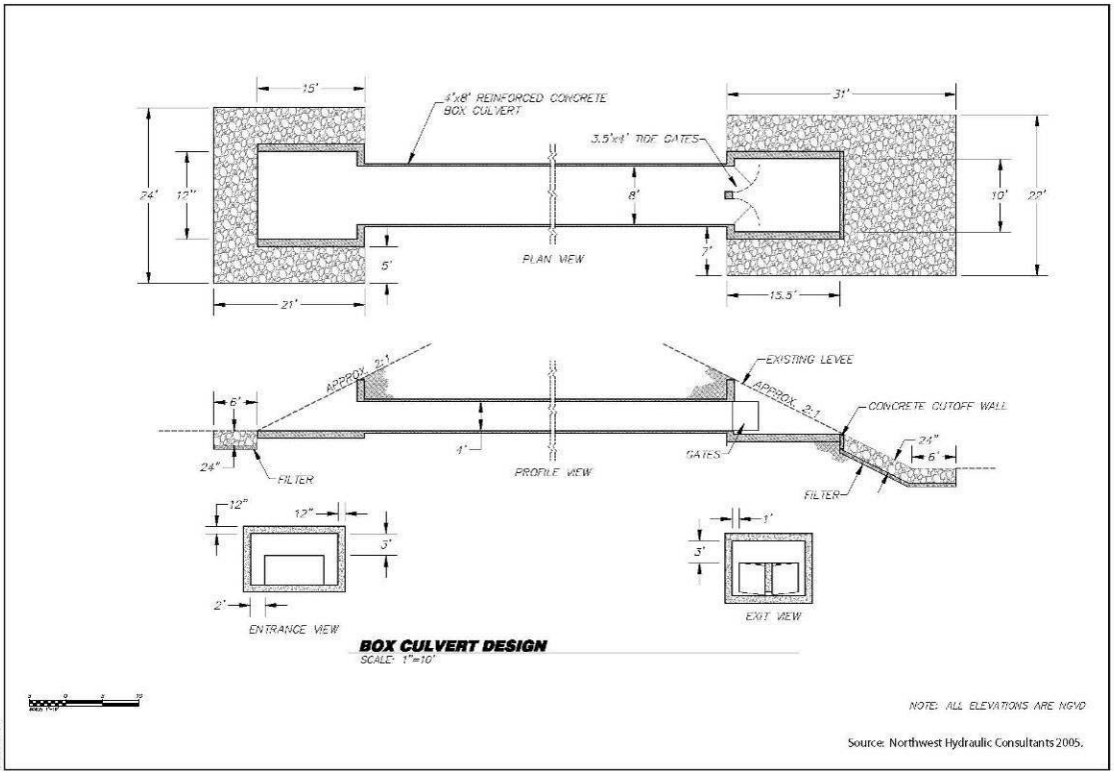


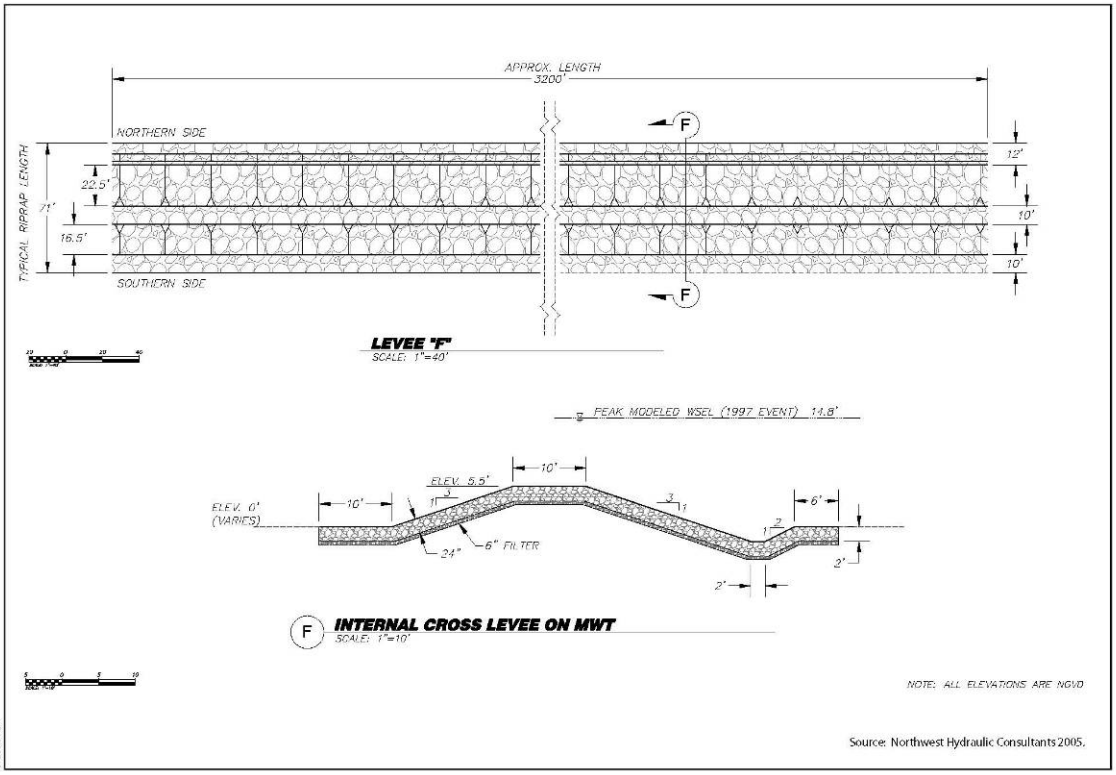

APPROX. LENGTH
3000'
48" LAUNCHABLE RIPRAP TOE
WATERSIDE
APPROX. 57'
APPROX. 88'
APPROX. 2:1
APPROX. 2:1
LANDSIDE
LEVEE "D"
SCALE: 1"=40'
APPROX. ELEV. 14.0'
PEAK MODELED WSEL (1997 EVENT) 14.5'
EXISTING LEVEE
RIPRAP ADDED OVER EXISTING LEVEE FACE
24"
FILTER
18"
RIVER CHANNEL
6'
PROTECTED WEST LEVEE ON DEAD HORSE ISLAND
SCALE: 1"=10'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


TYPICAL LEVEE CROSS SECTION
Riparian Forest
Scrub Shrub
Emergent Marsh
Mokelumne River
New Slope
Exisiting Slope
New Ditch
Exisiting Seep Ditch
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
DISTANCE (Feet)
Source: DWR.


LANDSIDE
100'
100'
100'
10'
10'
EXISTING LEVEE
APPROX. LEVEE DIMENSIONS
10'
B
APPROX. 2:1
114'
APPROX. 2:1
TYPICAL RIPRAP LENGTH
APPROX. ELEV. -13'
60" LAUNCHABLE RIPRAP TOE
WATERSIDE
6'
60.5'
LEVEE "B"
SCALE: 1"=40'
APPROX. ELEV. 17'
PEAK MODELED WSEL (1997 EVENT) 14.9'
3
1
30"
100'
100'
100'
30"
3
1
ELEV. 3.5'
ELEV. 0'
10'
FILTER
1
3
1
3
FILTER
60"
GRASS AND TULE PLANTINGS
B
LEVEE BREACH INLET CHANNEL ON MWT
SCALE: 1"=15'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


APPROX. LENGTH
3600'
LAUNCHABLE RIPRAP TOE
E
WATERSIDE
APPROX. 58'
APPROX. 2:1
5:1
10' ROADWAY
5:1
APPROX. 2:1
57'
60.5'
TYPICAL RIPRAP LENGTH
LANDSIDE
RIPRAP PROTECTION
LEVEE "E"
SCALE: 1"=40'
E
20'
EXISTING LEVEE
APPROX. ELEV. 15'
PEAK MODELED WSEL (1997 EVENT) 14.9'
12'
1'
ELEV. 5.5'
30"
APPROX. MTL 1.5'
ELEV. -2'
(VARIES)
6'
3'
RIPRAP PROTECTION
FILTER
60"
RIVER CHANNEL
CONCRETE CUT-OFF WALL
PAVED ROAD
1
2
2'
10'
E
DEGRADED SOUTHWEST LEVEE ON MWT
SCALE: 1"=10'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


15'
4'x8' REINFORCED CONCRETE BOX CULVERT
31'
3.5'x4' TIDE GATES
24'
12"
8'
10'
22'
5'
PLAN VIEW
7'
21'
15.5'
APPROX. 2:1
EXISTING LEVEE
APPROX. 2:1
6'
CONCRETE CUTOFF WALL
4'
24"
6'
24"
FILTER
PROFILE VIEW
GATES
FILTER
12"
12"
3'
1'
3'
2'
ENTRANCE VIEW
EXIT VIEW
BOX CULVERT DESIGN
SCALE: 1"=10'
NOTE: ALL ELEVATIONS ARE NGVD
Source: Northwest Hydraulic Consultants 2005.


APPROX. LENGTH
3200'
NORTHERN SIDE
F
12'
TYPICAL RIPRAP LENGTH
22.5'
71'
16.5'
10'
10'
SOUTHERN SIDE
F
LEVEE "F"
SCALE: 1"=40'
PEAK MODELED WSEL (1997 EVENT) 14.8'
10'
ELEV. 5.5'
3
1
3
1
6'
ELEV. 0'
(VARIES)
10'
1
2
24"
6" FILTER
2'
2'
F
INTERNAL CROSS LEVEE ON MWT
SCALE: 1"=10'
NOTE: ALL ELEVATIONS ARE NGVD
Source: Northwest Hydraulic Consultants 2005.

Appendix C: Project Description

This project description is derived from the Project Description in the North Delta Flood Control and Ecosystem Restoration Project Draft EIR Project Description (Volume 1, Chapter 2) and a Project Management Plan (PMP) prepared jointly by the US Army Corps of Engineers and Reclamation District 2110. The PMP contains excerpted information from Chapter 2. A final and more detailed Operations and Maintenance Plan will be completed as part of the Feasibility Study for the McCormack-Williamson Tract under the USACE Project Management Plan.

Overall Program Goals and Objectives

Flood Control

To achieve flood control objectives, the primary strategy for Group I is degrading portions of the levee system to allow controlled flow across McCormack-Williamson Tract and marina outreach to address boat hazards during floods. Secondarily, downstream levee modifications may be necessary to mitigate hydraulic impacts, and channel dredging may be implemented to increase flood conveyance capacity.

Ecosystem Restoration

Floodplain forests and marshes would be recreated at McCormack-Williamson Tract. Natural hydrologic processes would be restored through one of three pilot program strategies to meet different ecological objectives:

- maximizing fluvial and tidal processes to create a diverse network of riverine, floodplain, and tidal habitats based on natural sedimentation and channel formation;
- maximizing floodplain habitat to benefit fish that spawn and rear on the floodplain by allowing flooding (with some tidal action to maintain water quality) during the wet season; or
- creating floodplain habitat as described above, combined with a demonstration project to reverse subsidence and increase elevations on the tract.

Landside levee slopes would be planted with trees, shrubs, and native grasses to improve habitat for wildlife. DWR has prepared a more complete description of the ecosystem restoration for McCormack-Williamson Tract as envisioned and articulated as a conceptual model for each of the three pilot program strategies. These conceptual models were developed with input from the science panel, resource agency representatives, and other stakeholders.

Recreation

Opportunities for recreation would be developed to be compatible with flood control and ecosystem restoration through the development of public access for fishing, wildlife viewing, and boat use. Recreation could be enhanced by:

- opening up the southern portion of McCormack-Williamson Tract to boating and/or
- improving Delta Meadows property.

Degrade McCormack-Williamson Tract East Levee to Function as a Weir

Objective

Extensive hydraulic modeling shows that it is necessary to degrade a portion of the east and southwest levees on McCormack-Williamson Tract to achieve desired flood control benefits in the upper portion of the Project area measured as stage reductions at Benson's Ferry. Because the North Delta study area is limited by channel capacity, and McCormack-Williamson Tract levees are legally restricted in height, water may overtop the east levee on McCormack-Williamson Tract during large storm events. When the east levee is overtopped, McCormack-Williamson Tract fills and causes the southwest levee to breach catastrophically, causing a surge effect downstream that displaces boats and precipitates further levee failures. Lowering the elevation of the McCormack-Williamson Tract levees would allow flow to move through the tract in a controlled manner, eliminating this surge effect. To convey high river stages into McCormack-Williamson Tract, the degraded east levee would be reinforced as a hardened weir to direct flow and minimize erosion.

Location

This Project component would affect the east levee of McCormack-Williamson Tract, about 1,000 feet west of I-5. The affected portion of the levee is approximately 3,700 feet long.

Design and Construction

The east levee of McCormack-Williamson Tract would be lowered to allow floodflows onto the tract. Three thousand feet of the east levee would be degraded to an elevation of .feet (from an existing elevation of 17.5 feet to 18 feet). This elevation has been established to maintain the current level of access to the transmission tower via the east levee, including a layer of rock slope protection (RSP) consisting of angular rock placed along the entire face and crest of the degraded levee as prescribed by the USACE (USACE). The levee crest would also include a paved access road with concrete retaining walls to serve as a pavement-containment edge and to prevent undercutting. The riverside levee slope would be over-excavated and RSP would be placed to protect against erosion caused by turbulence in the approaching flow.

On the landside levee toe, a three-foot deep sill would be excavated to dissipate energy from overtopping water cascading down the landside levee face. RSP would be placed from the levee crest down the landside face, in the toe sill, and onto the floor of the island for an additional six feet beyond the toe sill. RSP placed on the landside face of the levee and on the floor of the island would be placed directly on the existing land surface to avoid unnecessary excavation. One or more filter layers would be placed under all RSP areas to prevent scour of the underlying soil. Grading and excavation of exit channels would ensure that fish are not entrapped in the toe sill as floodwaters recede from the island.

Operations and Maintenance

Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Completely Degrade McCormack-Williamson Tract Southwest Levee to Match the Elevation of the Island Floor

Objective

The southwest levee of McCormack-Williamson Tract would be lowered to allow floodflows to pass out of the tract without causing a surge effect, as described above. To convey high river stages out of McCormack-Williamson Tract, the degraded southwest levee would either be reinforced as a hardened weir to direct flow and minimize erosion or completely degraded to match the elevation of the island floor. During low-flow seasons, the lowered southwest levee would allow tidal exchange on the island from the south.

Location

The southwest levee of McCormack-Williamson Tract is located on the southwest side of the island adjacent to Dead Horse Cut.

Design and Construction

The McCormack-Williamson Tract southwest levee would be degraded along the entire length of Dead Horse Cut to match the elevation of the island floor from the existing elevation. This would allow floodflows to pass out of the tract without causing a surge effect. This would also allow tidal water onto the tract from the southern end, facilitating the formation of dendritic intertidal channels at elevations near sea level and keeping the southernmost portion of the tract as shallow open water. The potential for scour along the embankment between the untouched levee and the breach requires the placement of angular along the grade-matching slope as well as the adjacent levee faces. A launchable RSP toe should be placed along the base of the grade and in the river channel along the levee toe. The area of protection required will vary with levee geometry, the invert of the Mokelumne River, and landform elevation within the tract. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil.

Operations and Maintenance

This feature will be adaptively managed to avoid inducing growth of nonnative invasive species. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Reinforce Dead Horse Island East Levee

Objective

Because of increased lateral flows and higher velocities from water flowing through McCormack-Williamson Tract, the riverside face of the eastern levee on Dead Horse Island may require additional erosion protection.

Location

This levee is located along the eastern edge of Dead Horse Island, directly across Dead Horse Cut from the southwestern end of McCormack-Williamson Tract.

Design and Construction

The entire Dead Horse Island east levee is currently protected with RSP. To withstand the increased lateral flows and velocities associated with water flowing through McCormack-Williamson Tract, the Dead Horse east levee would be reinforced with the placement of RSP. A launchable toe would be placed in the river channel to prevent scour of the waterside toe of the levee. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil.

Operations and Maintenance

Vegetation management (by herbicide application, mowing, or removal with hand tools) is currently required to maintain the Dead Horse levee. After reinforcement of the Dead Horse east levee, similar vegetation management may be required periodically.

Modify Downstream Levees to Accommodate Potentially Increased Flows

Objective

To address the hydraulic effects of opening McCormack-Williamson Tract to more frequent inundation and flow, downstream levees would be raised as needed on the North Fork Mokelumne River to maintain freeboard.

Location

Levees are proposed to be raised as needed along portions of the North Fork Mokelumne River. Levees on opposite sides of the waterway are proposed to be raised in parallel (i.e., matching in profile).

Design and Construction

Hydraulic modeling results indicate that the implementation of Alternative -A would require minor levee raises along portions of the North Fork Mokelumne River. These modest increases could be accomplished by adding stabilized and compacted aggregate base to the levee crown and would not affect the footprint or sideslopes of the levee.

Operations and Maintenance

The levees affected by this component would continue to be managed as they are under existing conditions. These activities include vegetation management (by herbicide application, mowing, or removal with hand tools), placement of RSP to address waterside erosion, and restoration of the aggregate base patrol road with new material placed and graded to maintain a drivable surface.

Construct Transmission Tower Protective Levee and Access Road

Objective

Construction of a protective levee would be needed to maintain the current level of flood protection for the property being leased by KCRA. All alternatives are required to maintain the current level of flood protection and road access with no additional flood risk for the property being leased. The levee would protect the transmission tower and associated control building. Degrading the McCormack-Williamson east levee would necessitate constructing a new access road to the transmission tower.

Location

The transmission tower protective levee would be constructed in the northwest corner of McCormack-Williamson Tract. The access road would be constructed along the degraded portion of the east levee on McCormack-Williamson Tract.

Design and Construction

The length of the levee would be 4,000 feet. The elevation of the levee is to be set to maintain the current level of protection and would key into the existing north and south levees. Borrow, which could come from the Grizzly Slough property and the Dixon and New Hope borrow sites (still to be determined), would provide the extra soils needed to build this levee. The access road would be integrated with the hardened weir structure constructed on the degraded portion of the east levee. The road surface would provide all-weather access, proposed to be concrete at the weir and compacted aggregate base on the levee crown.

Operations and Maintenance

The levee would be maintained according to current levee standards for vegetation control, erosion protection, slope stability, and patrol access, in a similar condition to existing levees. The access road would be managed for vegetation, either by mowing or herbicide application at the shoulders and sideslopes. The aggregate base surface would be periodically refreshed with new material and graded to maintain a drivable surface. In the event that the transmission tower lease was not continued, maintenance may be terminated or the levee may be removed.

Demolish Farm Residence and Infrastructure

Objective

A multi-family farmworker residence (the two-story, wood-frame type commonly used for housing migrant farmworkers) and associated farm outbuildings (sheds) would be removed to allow water to flow unimpeded through the tract, to prevent the structures from being dislodged during high flows, and to complement restoration of the tract to habitat.

Location

The structures are located in two concentrations on the southeast levee in the upper half of McCormack-Williamson Tract

Design and Construction

The structures would be demolished with bulldozers, and the material would be hauled away by dump trucks to an appropriate permitted disposal site. Select material, such as doors, windows, siding, lumber, timbers, and steel, may be salvaged. It should be noted that fuel tanks are present and it is likely that agricultural chemicals have also been stored on site; therefore, these locations would need to be evaluated for the potential to contribute hazardous materials into the aquatic environment from inundation. These fuel tanks would be removed, and any legacy contamination would be safely removed before flooding is allowed to occur.

Operations and Maintenance

No operations or maintenance would be required for this component.

Modify Landform and Restore Agricultural Land to Habitat

Objective

The cultivation of agricultural crops on McCormack-Williamson Tract would be discontinued, and the land would be restored to native vegetation types for wildlife habitat. Restoration activities would include modifying the landform to ensure positive drainage and minimize the potential for fish-stranding.

Location

The interior of McCormack-Williamson Tract would be affected by this action, except for levee slopes and the area included by the transmission tower protective levee .

Design and Construction

Under the fluvial process optimization scenario, hydrologic and hydraulic forces as allowed by degrading and breaching the levees are envisioned to reform the interior of McCormack-Williamson Tract and facilitate conditions for natural revegetation. To assist these processes and facilitate habitat benefit, minor grading would occur to ensure positive drainage and provide more diverse geomorphic surfaces. At the upper end of the tract on the landside of the east levee, large depressions resulting from scour caused by previous levee failure events would be filled with material from the degraded east levee to reduce the risk of fish-stranding when high flows recede. Smaller depressions along the west side of the tract would be treated similarly.

At the lower end of the tract, starter channels would be graded at intertidal elevations to encourage formation of natural dendritic tidal channels and to ensure positive drainage to minimize the potential for fish-stranding. It is intended that a dendritic channel network would provide a maximum amount of edge habitat for native fish as well as provide positive draining of the tract after high-flow events to avoid fish-stranding. The channels would be located within the intertidal zone, which would be inundated at mean high high water (MHHW) levels but dry at mean low low water (MLLW) levels. The channels therefore would dry out on a daily basis, preventing the establishment of exotic submerged aquatic vegetation. The channel system would be designed to mimic natural dendritic systems, in which surface drainage streams branch randomly at various angles. Excess material would be used to fill depressions described above.

To facilitate conversion to native vegetative cover types, a combination of passive and active approaches likely would be used. It is acknowledged that risk inevitably is associated with natural revegetation. Many factors contribute to this risk, such as proliferation of weed species in Central Valley wetland systems that are adapted to more aggressive colonization than native species, an altered hydrologic regime that is unpredictable relative to native seed dispersal, and uncertainty of the actual hydrologic and hydraulic patterns caused by the Project. These and other details will be evaluated during engineering design with the goal of ensuring establishment of desirable native vegetation; however, it should be noted that sites in the Project watershed are successfully recolonizing with native species, such as those at the upstream Cosumnes River Preserve.

To reduce risk and minimize potential for colonization by exotic vegetation species, native and non-invasive starter vegetation would be planted, such as tule in the wetter southern portion of the island and grasses in the drier northern part. Over time, flooding events would import propagules such as willows, cottonwoods, and perennial herbs that would naturally colonize on higher areas and tules and other water plants at intertidal and subtidal elevations. Planting of other woody and herbaceous species may be proposed in the final Project design, if further study shows they are warranted to ensure native vegetative cover and preclude nonnative invasive species. A supplemental irrigation system may also be implemented to facilitate vegetation establishment. These active approaches to revegetation would likely focus on compensatory habitat required for mitigation of Project impacts.

Operations and Maintenance

The overall approach to land management would be relatively “hands off,” similar to practices at TNC’s upstream Cosumnes River Preserve. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically. Prescribed burning and strategic grazing will be evaluated as elements of the Project’s adaptive management plan. Herbivore protection shelters and fencing may also be needed to prevent plant predation from beavers, although beavers may provide a benefit by thinning forested areas to maintain diverse cover. These actions will be elements of the Project’s adaptive management plan. Irrigation, if needed, would use existing agricultural siphons with a pressurized closed delivery system (i.e., pipes and nozzles).

Breach Mokelumne River Levee

Objective

The Mokelumne River levee of McCormack-Williamson Tract would be breached to allow a secondary channel of the Mokelumne River to meander through the tract and establish hydraulic connectivity between the breach and the southwestern end of McCormack-Williamson Tract. A starter channel would be excavated to facilitate channel-forming processes in the interior of the tract. Riparian forest should colonize the channel banks.

Location

The -foot breach would be cut into the southern levee on McCormack-Williamson Tract at approximately Station + on the Mokelumne River.

Design and Construction

The breach would be broken down into two side tiers at elevation 3.5 feet and one central tier at 0 feet (NGVD). The lower tier would remain unprotected so that it could scour and eventually form into a natural channel inlet. The side tiers would be planted to protect against erosion and to precipitate colonization of the area by appropriate species. To protect the interface between the breach and the existing levee RSP) would be placed along the exposed 3:1 slope that matches the different grades. A launchable RSP toe would be placed in the river channel to prevent undercutting of the RSP. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil. A starter channel also would be excavated on the floor of the tract for approximately 3,000 feet to encourage flow through the inlet. The starter channel would be graded to integrate with the topography on the floor of the tract to minimize potential for fish-stranding and would drain toward the bottom of the tract.

Operations and Maintenance

This feature will be adaptively managed to avoid inducing growth of nonnative invasive species. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Appendix D: Project Management Plan

ERP Proposal Application Form

Appendix E: Adaptive Management Plan

Research Topic	Research Questions (Performance Measures)	Hypotheses (Success Criteria)	Potential Research Opportunities (Adaptive Management Responses)
Floodplain Processes	Is frequency of flooding by way of east levee and through the secondary channel? It is expected that annual flood frequency would be by way of secondary channel? Floodplain area (area flooded) is expected to be 400 acres. Does riparian habitat (starting with 200 acres along channel) increase over time to replace grassland (an additional 150 acres)? Does scour and deposition occur? Especially by water through floodplain channel? How do flooding and tidal processes interact?	Appropriate frequency of flooding to achieve multiple ecosystem restoration objectives. Appropriate flood plain area to achieve multiple ecosystem restoration objectives Scour and deposition are occurring at the site at an acceptable rate without damaging wildlife-friendly levees, etc. Flooding and tidal processes are compatible (e.g., flooding does not destroy formation of tidal channels or conversely filling of the McCormack-Williamson Tract with water from tidal processes does not inhibit riverine processes').	If there is a need to change frequency of flooding, adjust height of east levee and/or inflatable dam. Raise to increase frequency water shunted to Mokelumne River breach. Lower to increase frequency McCormack-Williamson Tract floods over east levee. May be restricted from lowering east levee below 8.5' msl due to access issues. If floodplain area is too small or too large, change factors that affect hydrology (east levee height, channel configuration). If scour and deposition are not occurring, change factors that affect hydrology (east levee height, channel configuration) to increase hydraulic energy. If scour and deposition are occurring too violently (such that the wildlife-friendly levees are threatened, for example), change factors that affect hydrology to lessen hydraulic energy or put in erosion protection. If flooding and tidal processes are incompatible (e.g., flooding destroys formation of tidal channels that are not reformed for many years, or conversely filling of the McCormack-Williamson Tract with water from tidal processes inhibits riverine processes), decide whether to preserve flooding (and raise southern levee to height inhibiting tidal action) or preserve tidal processes and inhibit flooding by raising east levee or closing off secondary channel.
Sedimentation/ **Geomorphic Processes**	What are the sedimentation rates in and around the secondary channel, floodplain, dendritic intertidal wetlands and southern shallow-water habitat area?	Sedimentation is occurring but not at rates that are higher than expected in secondary channel.	If sedimentation rates are higher than expected in secondary channel, is it still functioning to bring water onto the floodplain? If not, consider excavating channel further into the McCormack-Williamson Tract. If sedimentation is occurring in the northern portion of the McCormack-Williamson Tract, consider strategies (such as hydrologic changes or physical transfer) to transfer sediment to the southern portion of the McCormack-Williamson Tract.
Dendritic Intertidal Channels	Do they form as expected? Expect approximately 150	Dendritic intertidal channels form as expected.	If dendritic intertidal channels do not form as expected and instead there is emergent marsh or floodplain habitat, for example,

	acres of intertidal habitat at elevations -1' msl to 1' msl. Do channels dry out on tidal cycle?	Channels dry out on tidal cycle.	consider adjusting goals for that region to be the habitat that develops. If lack of channel formation is due to insufficient hydraulic energy, consider changes in the southern levee breach size and elevation or excavating starter channels that would increase the hydraulic energy. If elevations are not appropriate for formation of dendritic intertidal channels, consider relocating breaches. If channels do not dry out on tidal cycle, consider raising southern levee to eliminate the formation of tidal habitat and associated exotics or aggressive exotic species control. Install one-way flow gates or self-regulating tidal gates to facilitate draining of tidal channels.
Exotic Species Dominance	Does exotic aquatic vegetation predominate? Exotic fish? Native fish? Does aquatic exotic vegetation dominate perennial channel? Does aquatic exotic vegetation dominate intertidal wetlands? Does aquatic exotic vegetation dominate subtidal area in south? If so, does the subtidal area serve as a propagule source for exotic vegetation in the intertidal dendritic channels? Does terrestrial exotic vegetation predominate along permanent channel? Does terrestrial exotic vegetation dominate floodplain? Is it related to the flooding frequency? Does terrestrial exotic vegetation predominate on wildlife-friendly levees? Which part of wildlife-friendly levee	Native aquatic vegetation and fish predominate.	If exotic aquatic vegetation and fish predominate, consider aggressive exotic control measures or eliminating habitat by raising southern levee or installing water control gates If aquatic exotic vegetation dominate perennial channel, consider strategies to increase flow, use vegetation control methods or eliminate habitat by closing breach which allows channel formation. If aquatic exotic vegetation dominates intertidal wetlands, consider strategies to increase flow, use vegetation control methods or eliminate habitat by raising southern levee. If aquatic exotic vegetation dominates subtidal area in south, consider leveeing off southern area. If subtidal area serves as a propagule source for exotic vegetation in the intertidal dendritic channels, levee off subtidal area or use aggressive exotic vegetation control methods in subtidal area (may need to contain areas for treatment). If terrestrial exotic vegetation predominates along permanent channel, remove by cutting or other control methods, consider closing channel, changing factors that affect hydrology (increasing or decreasing water levels, for example), by changing breach or weir configuration. If terrestrial exotic vegetation dominates floodplain and is related to flooding frequency, change factors that affect hydrology/flooding frequency. Or use vegetation control methods.

	(emergent marsh, scrub-shrub or riparian habitat)? Do exotic fish predominate in channel? Do exotic fish predominate in intertidal dendritic wetlands? Do exotic fish dominate subtidal area in south? Do they serve as a source for exotic fish in the intertidal dendritic wetlands?		If terrestrial exotic vegetation predominates on wildlife-friendly levees (emergent marsh, scrub-shrub or riparian habitat), use vegetation control methods (including herbicides, goats, for example) and/or plant native species to displace exotic species. If exotic fish predominate in channel related to flow, increase flow by changing breach dimensions or use exotic fish control strategies. If necessary, eliminate habitat by closing breach. If exotic fish predominate in intertidal dendritic wetlands, control fish or hydrology by installing water control weirs, self-regulating tidal gates. Eliminate habitat by raising southern levee. If exotic fish dominate subtidal area in south, try control strategies (may have to isolate areas for treatment). If related to hydrology, change factors that affect hydrology. If the subtidal area serves as a source for exotic fish in the intertidal dendritic wetlands, levee off the southern subtidal area.
Fish Stranding	Do fish strand in northern floodplain area after flooding events? Expect fish to navigate to aquatic areas in south; however natural levees that form along starter channel may present a barrier to fish. Are fish stranded during the outgoing tide in the dendritic intertidal channels?	Fish do not get stranded in northern floodplain area after flooding events. Fish do not get stranded during the outgoing tide in the dendritic intertidal channels.	If fish strand in northern floodplain area after flooding events, consider filling in low areas where stranding occurs. Change flooding area by changing factors that affect hydrology. If secondary channel facilitates fish stranding, consider eliminating secondary channel by closing breach. If fish stranded during the outgoing tide in the dendritic intertidal channels, consider grading to facilitate drainage into the channels, eliminating low areas where ponding might occur or changing factors that affect hydrology (perhaps installing gates to mute tides).
Mosquito Management	Is there significant mosquito production in floodplain? During what months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in permanent channel? During what	Insignificant mosquito production in floodplain when flooded. Insignificant mosquito production in southern area where nekton gates circulate water.	If significant mosquito production in floodplain, consider mosquito control methods (such as insecticide), eliminating low areas where ponding might occur, improving drainage by grading. If associated with specific vegetation, consider controlling/changing vegetation. If hydrologic changes would lessen mosquito production without undue ecological effects, consider changing factors that affect hydrology. If significant mosquito production in permaner channel, consider control methods in channel

	months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in dendritic intertidal wetlands? During what months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in subtidal area in south? During what months of year and what flow conditions? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in floodplain when flooded (dry June-December)? During what months of year? Is mosquito production associated with presence of vegetation?		have to isolate treatment areas). If this occurs during certain flow conditions (such as low flo consider changes to channel geometry (narro channel, for example) to increase flow. If associated with presence of vegetation, consi removing or altering vegetation. If significant mosquito production in dendritic intertidal wetlands, consider control methods (insecticide), changing factors that affect hydrology (perhaps specific to certain seasons when mosquitoes are most problematic). If mosquito production associated with presence of vegetation, consider vegetation control. If significant mosquito production in subtidal area in south, use mosquito control measures, make changes that affect hydrology (perhaps increasing flow rates by creating additional breaches, removing vegetation or other obstructions to flow), controlling vegetation if mosquitoes are associated with vegetation, or building levees to isolate the subtidal area. If significant mosquito production in floodplain when flooded, use mosquito control (insecticide), increase circulation through additional breaches, control vegetation, or reduce area of floodplain habitat.
Methylmercury	Is mercury methylation on floodplain significant? Is mercury methylation in dendritic intertidal wetlands significant? Is mercury methylation in subtidal area significant?	Mercury methylation on floodplain is insignificant and not affected by hydrology. Mercury methylation does not vary by area of floodplain (water depth) during times when floodplain is flooded	If mercury methylation on floodplain significant and affected by hydrology (east levee height or secondary channel dimensions), adjust factors that affect hydrology. Consider eliminating habitat by raising east levee or closing Mokelumne River breach that forms secondary channel. If mercury methylation in dendritic intertidal wetlands significant and affected by hydrology, adjust factors that affect hydrology. Consider eliminating habitat. If mercury methylation in subtidal area is significant and affected by hydrology, change factors that affect hydrology. Consider eliminating habitat.

Organic Carbon	Is organic carbon on floodplain exported to channels during flood events? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels? Organic carbon production and export from permanent channel? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels? Organic carbon production and export in dendritic intertidal wetland area? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels?	Organic carbon on floodplain is not exported to channels during flood events unlikely to increase organic carbon levels at SWP pumps. Self-regulating tidal gates and tidal circulation during flooded months (January-May) does not affect organic carbon production and export into adjacent channels.	If organic carbon on floodplain exported to channels during flood events and likely to increase organic carbon levels at SWP pumps and other drinking water diversions, consider holding water on-island and treatment or modifications to hydrology/flow paths that might lessen organic carbon export. Weigh against ecological benefits in channels due to organic carbon export. If organic carbon production and export from permanent channel significant, consider eliminating permanent channel, in-channel treatment, or preventing permanent channel from draining from island during certain time periods. (Since organic carbon loads are greatest during winter and time of most significant diversions, unlikely to be able to control organic carbon export during this time due to flooding conditions). If organic carbon production and export in dendritic intertidal wetland area, consider raising southern levee to eliminate habitat (assuming water quality effects outweigh ecological benefits).
Subsidence Reversal	Does accretion occur in the emergent marsh area? At what rate?	Accretion is occurring on the floodplain at an appreciable rate.	If accretion is not occurring in the emergent marsh area, consider other strategies such as adding brush boxes, changing hydrology by modifying the southern levee opening to enhance settlement.

Appendix F: Hydraulic Model

Appendix A: List of Permits

(From the North Delta Flood Control and Ecosystem Restoration Project Mitigation, Monitoring, and Reporting Program)

NOTE: The following attachment contains a description of the environmental and other permits needed to implement the proposed project. The attached document is the Mitigation, Monitoring, and Reporting Program from the North Delta Flood Control and Ecosystem Restoration Project EIR. The USACE Feasibility Study will determine the precise nature of permits needs to proceed with the project.

EXHIBIT D: MITIGATION MONITORING AND REPORTING PROGRAM

NORTH DELTA FLOOD CONTROL AND ECOSYSTEM RESTORATION EIR

CEQA requires the adoption of feasible mitigation measures to reduce the severity and magnitude of potentially significant environmental impacts associated with project development.

CEQA *Guidelines* Section 15091(d) states:

> When making the findings required in subdivision (a)(1), the agency shall also adopt a program for reporting on or monitoring the changes which it has either required in the project or made a condition of approval or substantially lessen significant environmental effects. These measures must be enforceable through permit conditions, agreements, or other measures.

CEQA *Guidelines* Section 15097(a) states:

> This section applies when a public agency has made the findings required under paragraph (1) of subdivision (a) of section 15091 relative to an EIR or adopted a mitigated negative declaration in conjunction with approving a project. In order to ensure that the mitigation measures and project revisions identified in the EIR or negative declaration are implemented, the public agency shall adopt a program for monitoring or reporting on the revisions which it has required in the project and the measures it has imposed to mitigate or avoid significant environmental effects.

The Final EIR for the North Delta Flood Control and Ecosystem Restoration Project includes mitigation measures to reduce the potential environmental effects of the proposed project. Findings were made in Exhibit B as required under CEQA *Guidelines* Section 15091 (a)(1) which include mitigation measures.

Following certification of the Final EIR and approval of the proposed project, of the Findings in Exhibit B and of this Mitigation Monitoring and Reporting Program (MMRP) by the Director of the Department, the mitigation measures that are within the jurisdiction and responsibility of the Department (DWR) that been required in, or incorporated into the approved project, will be monitored in the manner specified in this MMRP.

Alternatives 1-A and The No Action Alternative for the Group 2 actions are identified as the Preferred Alternatives based on the analysis in the Draft EIR, and comments received during the public comment period and public hearing.

The following MMRP Matrix includes all of the applicable mitigation and monitoring information for the proposed project.

MMRP DETERMINATION

I adopt the Mitigation, Monitoring and Reporting Program set forth in this Exhibit D, which meets the requirements of CEQA Guidelines Section 15091(d)

for Mark W. Cowin, Director

11/8/10
Date

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
3.2 FLOOD CONTROL AND LEVEE STABILITY			
Mitigation Measure FC-1: Develop a Seepage-Monitoring Program A seepage-monitoring program will be implemented in conjunction with the North Delta Seepage Monitoring Program to establish a baseline, provide early detection of seepage problems caused by the project, and quantify and document seepage as the basis for appropriate mitigation and compensation measures. This seepage monitoring program will be supplemental to the existing North Delta Seepage Monitoring Program initiated in 1993 to establish baseline groundwater conditions adjacent to stream channels in the North Delta that were proposed to be enlarged as part of the North Delta Program. To the extent that the seepage monitoring indicates impacts attributable to the Project, relief wells will be installed to mitigate such impacts.	DWR or contractor will develop a seepage monitoring program to supplement the existing North Delta Seepage Monitoring Program.	DWR Project Manager	Pre- and Post-construction of project
3.4 WATER QUALITY			
Mitigation Measure WQ-1: Monitor for mercury and MeHg levels in water and sediments in the McCormack-Williamson Tract and Grizzly Slough vicinities both before and after restoration activities take place.	DWR or its contractor will develop water quality plan to	DWR Project Manager	Pre- and Post-construction of project

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
A water quality plan will be developed to monitor for mercury and MeHg levels in water and sediments in the McCormack-Williamson Tract and Grizzly Slough vicinities both before and after restoration activities take place. This monitoring would provide baseline conditions at the site and will allow for comparisons between pre and post restoration MeHg levels. The information will aid in determining potential site management changes in the future, as well as advance the general body of knowledge on the subject of MeHg creation and export in restored tidal marshes. It is likely that these monitoring activities will be coordinated with the creation of the Delta Mercury TMDL.	monitor for elemental and methylmercury before and after project implementation and may adopt site management changes depending upon water quality monitoring results.		
3.6 Groundwater			
Mitigation Measure GW-1: Control Seepage The North Delta Seepage Monitoring Program developed by DWR shall be enhanced to verify that seepage rates will not increase significantly. The enhanced seepage monitoring network should be extensive enough to assess potential design options early in the design phase. The network needs to be upgraded through additional borings deep enough to be below the footing grades of any potential grout-seal walls. The geologic cross sections should be developed along each reach where additional flooding is planned. Additional monitoring wells should be equipped with data loggers capable of frequent monitoring of groundwater levels and temperature. With an upgraded monitoring capability, an increase in seepage rates will be adaptively managed, and additional protection will be provided if implementation has larger impacts than estimated. Additional geotechnical and groundwater data should be acquired and examined during the initial design to determine and provide direction on method(s) of seepage control most appropriate to protect the lands adjacent to McCormack-Williamson Tract which potentially would be affected by frequent inundation of McCormack-Williamson Tract. Common methods of seepage control are internal drainage, seepage berms, cutoff walls, passive relief wells, and active pumping wells. The first two methods, internal drainage and seepage berms, primarily affect seepage locally near the levee and may not be effective in	DWR or contractor will develop a seepage monitoring program to supplement the existing North Delta Seepage Monitoring Program	DWR Project Manager	Design and construction phases

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
controlling seepage migration away from the levee. Therefore, mitigation will consist of cutoff walls or passive relief and pumping wells, depending on final design determination. For cutoff walls to be effective from practical and cost perspectives, there needs to be a low hydraulic conductivity layer beneath the seepage layers into which a cutoff wall can be extended. While cutoff walls have been extended to depths of more than 100 feet, more practical depths are less than about 60 feet. Where low hydraulic conductivity soils are deeper than about 80 feet, deep pumping wells may be required to control seepage and maintain groundwater levels at pre-flooding levels on adjacent properties. If damages are documented as a direct result of project implementation, the Reclamation District may seek compensation from the United States Army Corps CALFED Levee Stability Program or DWR's Delta Levees and Environmental Engineering Special Projects Program.			
3.3 Geomorphology and Sediment Transport			
Mitigation Measure GEO-1: Conduct Geotechnical Evaluation for Sediments Susceptible to Liquefaction, and Design Project to Accommodate Effects of Liquefaction. The Project applicant, in conjunction with soil scientists or engineers, will be responsible for conducting a geotechnical evaluation of unconsolidated sediments in the Project area to determine whether they are susceptible to liquefaction. Based on subsurface conditions, the Project applicant, in conjunction with soil scientists or engineers, will design the Project to accommodate the effects of liquefaction. The presence of levees that can safely store water without modification of the substrate is considered an acceptable engineering approach. The effects of liquefaction may include lateral deformation or vertical settlement that can be accommodated within the design of the levee or other improvements.	DWR or contractor will be responsible for conducting a geotechnical evaluation of unconsolidated sediments in the Project area to determine whether they are susceptible to liquefaction.	DWR Project Manager	Design Phase Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure GEO-2: Conduct Geotechnical Evaluation for Expansive Soils, and Design Project to Accommodate Effects of Expansive Soils. The Project applicant, in conjunction with soil scientists or engineers, will be responsible for conducting a geotechnical evaluation for expansive soils. Based on subsurface conditions, the Project applicant, in conjunction with soil scientists or engineers, will design the Project structures to accommodate the effects of expansive soils. The presence of levees that can safely store water without modification of the substrate is considered an acceptable engineering approach. Expansive soils that are buried deep or below the groundwater level would not affect surface structures. Therefore, there is no impact, and no modification of soils would be necessary.	DWR or contractor	DWR Project Manager	Pre-construction
3.9 Air Quality			
Mitigation Measures to Reduce Greenhouse Gas Emissions. Construction crews will be required to follow Mitigation Measures (MMs) for reduction of emissions, such as limits on idling, keeping engines in tune, and possibly retrofits to increase fuel efficiency. These MMs will be included in worker environmental education sessions. All measures in the CARB "Heavy-Duty Vehicle Greenhouse Gas Emission Reduction Measures" will also be adhered to if the measures have been instituted by the time construction starts. **Mitigation Measure 1a:** DWR shall ensure that contractors implement a fugitive dust control program pursuant to the provisions of SMAQMD Rule 403. The purpose of this rule is to reasonably regulate operations that periodically may cause fugitive dust emissions into the atmosphere. **Mitigation Measure 1b:** DWR shall ensure that construction equipment is properly tuned and maintained in accordance with manufacturer's specifications. **Mitigation Measure 1c:** DWR shall ensure that contractors maintain and operate construction	DWR, or its construction monitor, will assure that all Mitigation Measures are followed.	DWR Project Manager	During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
equipment so as to minimize exhaust emissions. During construction, trucks and vehicles in loading and unloading queues would turn their engines off when not in use to reduce vehicle emissions. Construction emissions shall be phased and scheduled to avoid emissions peaks and discontinued during second-stage smog alerts. **Mitigation Measure 1d:** Electricity from power poles rather than temporary diesel- or gasoline-powered generators shall be used where available. **Mitigation Measure 1e:** All construction vehicles shall be prohibited from idling in excess of five minutes, both on- and off-site. **Mitigation Measure 1f:** Coatings and solvents used in the proposed project shall be consistent with applicable SMAQMD rules and regulations. **Mitigation Measure 1g:** Wheel washers shall be installed where vehicles exit the construction site onto paved roads. **Mitigation Measure 1h:** Haul vehicles shall be covered or comply with the vehicle freeboard requirements of Section 23114 of the California Vehicle Code for both public and private roads. **Mitigation Measure 1i**: Prior to removing the existing drainage system down-stream of the dam, DWR shall inventory materials that may be asbestos-containing. Any asbestos containing materials including cement pipe (transite) will be removed and disposed of by certified asbestos workers in compliance with applicable asbestos abatement regulations(40 CFR Part 763 and 29 CFR Part 1910).			
Mitigation Measure AIR-1: Implement all Mitigation Measures from the CALFED Bay-Delta Program Final Programmatic EIS/EIR. The Project proponent will ensure that all applicable mitigation measures included in the 2002 CALFED Bay-Delta Program Final Programmatic EIS/EIR are implemented. These mitigation measures include CALFED Programmatic Mitigation Measures 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, and 13:	DWR or its construction monitor will assure that all mitigation measures are implemented.	DWR Project Manager	During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
1. Setting traffic limits on construction vehicles. 2. Maintaining properly tuned equipment. 3. Limiting the hours of operation or amount of equipment. 5. Coordinating prescribed burning programs with relevant air quality management agencies to ensure that the programs are accounted for in state and federal air quality management plans. 6. Regular, periodic watering of construction sites to control levels of dust in the air. 7. Using soil stabilizers and dust suppressants on unpaved service roadways. 8. Daily contained sweeping of paved surfaces. 9. Limiting vehicle idling time. 10. Using alternatively fueled equipment. 11. Requiring selection of borrow sites that are closest to fill locations. 12. Implementing construction practices that reduce generation of particulate matter. 13. Hydroseeding and mulching exposed areas.			
Mitigation Measure AIR-2: Implement SMAQMD Requirement to Reduce NO_X Emissions from Off-Road Diesel-Powered Equipment. The Project proponent shall provide a plan, for approval by the lead agency and **SMAQMD**, demonstrating that the heavy-duty (> 50 horsepower) off-road vehicles to be used in the	DWR or its construction monitor will provide SMAQMD the air quality plan and an	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
construction Project, including owned, leased, and subcontractor vehicles, will achieve a Project-wide fleet average of 20% NO_x reduction and 45% particulate reduction[1] compared to the most recent CARB fleet average at time of construction. The Project representative shall submit to the lead agency and SMAQMD a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, that will be used an aggregate of 40 or more hours during any portion of the construction Project. The inventory shall include the horsepower rating, engine production year, and projected hours of use or fuel throughput for each piece of equipment. The inventory shall be updated and submitted monthly throughout the duration of the Project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs. At least 48 hours prior to the use of subject heavy-duty off-road equipment, the Project representative shall provide the SMAQMD with the anticipated construction timeline, including start date and name and phone number of the Project manager and on-site foreman.	inventory of all off-road construction equipment equal or greater than 50 horsepower that will be used for more than 40 hours during any portion of the construction Project.		During construction
Mitigation Measure AIR-3: Implement SMAQMD Requirement to Control Visible Emissions from Off-Road Diesel-Powered Equipment. The Project proponent shall ensure that emissions from all off-road diesel-powered equipment used on the Project site do not exceed 40% opacity for more than 3 minutes in any 1 hour. Any equipment found to exceed 40% opacity (or Ringelmann 2.0) shall be repaired immediately, and the lead agency and SMAQMD shall be notified within 48 hours of identification of noncompliant equipment. A visual survey of all in-operation equipment shall be made at least weekly, and a monthly summary of the visual survey results shall be submitted throughout the duration of the Project, except that the monthly summary shall not be required for any 30-day period in which no construction activity occurs. The monthly summary shall include the quantity and type of vehicles surveyed as well as the dates of each survey. The SMAQMD and/or other officials may conduct periodic site inspections to determine compliance. Nothing	DWR or its construction monitor will assure that all mitigation measures are implemented.	DWR Project Manager	During Construction

[1] Acceptable options for reducing emissions may include use of late model engines, low-emission diesel products, alternative fuels, use of electrically powered equipment, engine retrofit technology, after-treatment products, and/or other options as they become available.

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
in this section shall supersede other SMAQMD or state rules or regulations.			
Mitigation Measure AIR-4: Implement SMAQMD Requirement to Pay an Off-Site Mitigation Fee. The SMAQMD requires that all projects with construction emissions in excess of the their threshold of significance after application of the SMAQMD's standard construction mitigation measures (Mitigation Measures AIR-2 and AIR-3) pay an off-site mitigation fee to reduce construction-related emissions of NO_x to a less-than-significant level. As previously indicated, this analysis is based on incomplete, preliminary, and assumed data, with an assumption that construction activities associated with each Project component would occur throughout the duration of the months scheduled and that all equipment will be in operation for each appropriate component to represent a worst-case scenario. Because of this approach, Project emissions represent a worst-case scenario and are likely to be lower when Project-specific data (e.g., the exact phasing and scheduling of construction activities, the types and number of construction equipment pieces that will be used, etc.) are known. Consequently, this analysis does not quantify the Off-Site Mitigation Fee payable to the SMAQMD. Rather, once this Project- specific data is known, prior to the approval of improvement plans or the issuance of grading permits, the Project proponent will calculate Project-specific construction emissions associated with the Project and submit proof that the off-site air quality mitigation fee of has been paid to SMAQMD and that the construction air quality mitigation plan has been approved by SMAQMD and the lead agency. The Off-Site Mitigation Fee is calculated by estimating the pounds of mitigated daily NO_x emissions over the SMAQMD's 85 pounds per day threshold, divided by 2000 pounds per ton, multiplied by the number of days of construction, and multiplied by the standard SMAQMD fee of $13,600/ton of NO_x.	DWR or its construction monitor will develop project specific data on construction related emissions and provide proof that off-site air quality mitigation fee has been paid.	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure AIR-5: Consult with SMAQMD and SJVAPCD Implement Approved Emissions Reduction Programs or Offsets to Reduce Operational Emissions. The Project proponent will consult with the SMAQMD and SJVAPCD to determine required measures to reduce the impacts to less-than-significant levels. The Project proponent shall either require the contractor to obtain an air quality permit from the SMAQMD and SJVAPCD or the Project proponent shall contract with the SMAQMD and SJVAPCD for emission reduction credits or funding for an emission reduction program. Emission Reduction Credits shall be provided by either leasing approved credits from the SMAQMD and SJVAPCD emissions reductions credit bank or by funding an emission reduction project that will provide equivalent emission reductions as approved by SMAQMD and SJVAPCD. The Project proponent will implement the SMAQMD- and SJVAPCD approved emissions reduction programs or offsets to reduce emissions to a level considered less than significant by the SMAQMD and SJVAPCD.	DWR or its construction monitor will consult with SMAQMD to determine appropriate measures to reduce air quality impacts to less-than-significant levels.	DWR Project Manager	Design and construction phase
Mitigation Measure AIR-6: Require Construction Contractors to Use Equipment with Valid Statewide Portable Equipment Registrations or to Obtain an Operating Permit from the SMAQMD and SJVAPCD. In the event that electric equipment is not available, the Project proponent shall require construction contractors to use equipment with a valid Statewide Portable Equipment Registration or obtain a permit from the SMAQMD and SJVAPCD for equipment to be used. In the event that the equipment is subject to the Portable Equipment Registration Program and has not previously operated in the SVAB and SJVAB is not part of the planning inventory for the SVAB and SJVAB, then the Project proponent or the contractor shall provide emission reduction credits to reduce the Project impacts to a less-than-significant level in accordance with Mitigation Measure AIR-6.	DWR or its construction monitor will use equipment with a valid Statewide Portable Equipment Registration or obtain a permit from the SMAQMD for equipment to be used.	DWR Project Manager	Design and construction phase

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
3.10 Noise			
Mitigation Measure NZ-1: Limit Noise-Generating Construction Activity and Heavy Trucking to Daytime Hours. DWR will limit noise-generating construction activity within 2,500 feet of occupied residences and heavy trucking within 400 feet of occupied residences to the hours between 6:00 a.m. and 8:00 p.m.	DWR, or its construction monitor, will take noise sensitive land uses into account when establishing haul routes	DWR Project Manager	During construction
4.1 Vegetation and Wetlands			
Mitigation Measure VEG-1: Replace Valley/Foothill Riparian Cover Types. Compensation will include restoring or enhancing in-kind riparian habitat at a ratio of 1 to 3 acres or greater, for each acre affected. The mitigation ratio for federally listed Threatened or Endangered species will be determined by USFW, which will issue a jeopardy or no-jeopardy opinion (subsequent to a Section 7 consultation). Mitigation ratios for state listed threatened or endangered species will be determined through the 2081 permitting process. The MSCS Conservation Measure recommends restoring or enhancing 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts are incurred before implementing actions that could result in the loss or degradation of habitat (CALFED Bay-Delta Program 2000e). As much of the mitigation habitat as possible will be created on site or near the Project area. This mitigation is consistent with the following MCSC Conservation Measure (CALFED Bay-Delta Program 2000e): To the extent practicable, include Project design features that allow for onsite reestablishment and long-term maintenance of riparian vegetation following Project construction. Restoration of the riparian communities would be done immediately following construction	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Initial surveys have been completed. Additional surveys will be conducted prior to construction Design phase

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
activities by controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow the natural reestablishment of the affected plant community. Flooding events would import propagules such as willows, cottonwoods, and perennial herbs that would naturally colonize frequently flooded portions of the site. In addition to the requirements of the MSCS Conservation Measures, DWR will prepare a revegetation plan and monitor the restoration or enhancement mitigation sites. The revegetation plan will be prepared by a qualified restoration ecologist and reviewed by the appropriate agencies. The revegetation plan will specify the planting stock appropriate for each riparian land cover type and each mitigation site, ensuring the use of genetic stock from the North Delta area. The plan will employ the most successful techniques available at the time of planting. Success criteria will be established as part of the plan. Planting will be maintained for a minimum of 5 years, including weed removal, irrigation, and herbivory protection. DWR will monitor the plantings annually for 4 years, followed by monitoring in years 8 and 10 following initial mitigation implementation, to ensure they have established successfully. DWR will submit annual monitoring reports of survival for the first 4 years to the regulatory agencies issuing permits related to habitat impacts—DFG, USACE, and USFWS. Replanting will be necessary if success criteria are not being met. The riparian habitat mitigation will be considered successful when the number of sapling trees established meet the success criteria, the habitat no longer requires active management, and vegetation is arranged in groups that, when mature, replicate the area, natural structure, and species composition of similar riparian habitats in the region.			Post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure VEG-2: Avoid and Minimize Impacts on Sensitive Biological Resources. DWR will include the following measures to minimize indirect impacts on sensitive natural communities, including riparian habitats, waters of the United States, and special-status plants: 1. DWR will provide an on-site biologist/environmental monitor who will be responsible for monitoring implementation of the conditions in the state and federal permits (CWA Section 401, 402, and 404; ESA Section 7; Fish and Game Code Section 1601; Project plans (SWPPP); and EIS/EIR mitigation measures). 2. The on-site biologist/environmental monitor will determine the location of environmentally sensitive areas adjacent to construction sites based on mapping of existing land cover types and special-status plant species, unless observed field conditions warrant a modification of the environmentally sensitive area boundaries. To avoid construction-phase disturbance of sensitive habitats immediately adjacent to the Project site, the monitor will identify the boundaries and add a 50-foot buffer where feasible with orange construction barrier fencing. The fencing will be mapped on the Project construction drawings. Erosion control fencing will also be placed at the edges of construction where the construction activities are upslope of wetlands and channels to prevent washing of sediments from the construction site into surrounding environmentally sensitive areas. The environmentally sensitive–area and erosion-control fencing will be installed before any construction activities are initiated, and it will be maintained throughout the construction period.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Pre-construction During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
DWR will provide a worker environmental training program for all construction personnel before the start of construction activities. The program will educate workers about special-status species, riparian habitats, and waters of the United States present on and adjacent to the site, and the regulations and penalties for unmitigated effects on these sensitive biological resources. Where feasible, construction will avoid and minimize trimming or complete removal of vegetation. Following construction, the construction contractor will remove all litter and construction debris and implement a revegetation plan for temporarily disturbed vegetation in the construction zones. The elements that should be included in the revegetation of these sites are described in Mitigation Measures VEG-1, VEG-3, and VEG-8.			Post-construction
Mitigation Measure VEG-3: Replace Nontidal Freshwater Emergent Wetland Cover. Compensation will include restoring or enhancing in-kind riparian habitat at a ratio of 1 to 3 acres or greater, for each acre affected. The mitigation ratio for federally listed Threatened or Endangered species will be determined by USFW, which will issue a jeopardy or no-jeopardy opinion (subsequent to a Section 7 consultation). Mitigation ratios for state listed threatened or endangered species will be determined through the 2081 permitting process. As much of the mitigation habitat as possible will be created on site or near the Project area. The MSCS Conservation Measure recommends restoring or enhancing 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts are incurred before implementing actions that could result in the loss or degradation of habitat (CALFED Bay-Delta Program 2000e). This mitigation is consistent with the following MCSC Conservation Measure (CALFED Bay-Delta Program 2000e): To the extent practicable, include Project design features that allow for onsite reestablishment and long-term maintenance of natural seasonal wetland vegetation (includes nontidal emergent wetland cover types) following Project construction.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Design and pre-construction phase Post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Restoration of the wetland communities would be done immediately following construction activities by controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow the natural reestablishment of the affected plant community. Flooding events would import propagules that would naturally colonize frequently flooded portions of the site. In addition to the requirements of the MSCS Conservation Measures, DWR will prepare a revegetation plan and monitor the restoration or enhancement mitigation sites. The revegetation plan will be prepared by a qualified restoration ecologist and reviewed by the appropriate agencies. The revegetation plan will specify the planting stock appropriate for each nontidal freshwater emergent wetland land cover type and each mitigation site, ensuring the use of genetic stock from the North Delta area. The plan will employ the most successful techniques available at the time of planting. Success criteria will be established as part of the plan. Planting will be maintained for a minimum of 5 years, including weed removal and herbivory protection.DWR will monitor the plantings annually for 4 years, followed by monitoring in years 8 and 10 after initial mitigation implementation, to ensure they have established successfully. For the first 4 years, DWR will submit annual monitoring reports of survival to the regulatory agencies issuing permits related to habitat impacts—DFG, USACE, and USFWS. Replanting will be necessary if success criteria are not being met. The nontidal freshwater emergent wetland habitat mitigation will be considered successful when the number of emergent wetland species established meet the success criteria, the habitat no longer requires active management, and vegetation is arranged in groups that, when mature, replicate the area, natural structure, and species composition of similar nontidal freshwater emergent wetland habitats in the region.			Post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure VEG-6: Avoid Introduction and Spread of New Noxious Weeds during Project Construction. DWR will include the following measures in the Project construction conditions to minimize the potential for the introduction of new noxious weeds and the spread of weeds previously documented in the Project area: Educate construction supervisors and managers on weed identification and the importance of controlling and preventing the spread of noxious weed infestations. Treat isolated infestations of giant reed or other noxious weeds identified in the Project area with approved eradication methods at an appropriate time to prevent further formation of seed and destroy viable plant parts and seed. Minimize surface disturbance to the greatest extent possible. Seed all disturbed areas with certified weed-free native and nonnative mixes, as provided in the revegetation plan developed in cooperation with DFG. Mulch with certified weed-free mulch. Rice straw may be used to mulch upland areas. Use native, noninvasive species or nonpersistent hybrids in erosion control plantings to stabilize site conditions and prevent invasive species from colonizing. Restore or enhance suitable habitat areas that are occupied by, or are near and accessible to, special-status species that have been adversely affected by the permanent removal of occupied habitat areas.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	During and post construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure VEG-7: Conduct Preconstruction Surveys for Special-Status Plants. Within 1 year before initiating construction, DWR will conduct special-status plant surveys of all proposed areas of disturbance. The purpose of these surveys will be to verify that the locations of special-status plants in the 2004 surveys are extant, identify any new special-status plant occurrences, cover any portions of the Project area not previously identified, and map tidal mud flat habitat in the Project area, including the construction footprints. The survey also will evaluate the habitat quality based on surrounding habitats (e.g., adjacent levee banks with RSP based on surrounding habitats (e.g., adjacent levee banks with RSP would lower the habitat quality, adjacent riparian vegetation would increase habitat quality). The extent of both habitat occupied by special-status plant species and unoccupied tidal mud flat habitat will be quantified for use in determining the amount of habitat mitigation required under Mitigation Measure VEG-5. This mitigation is consistent with the MSCS Conservation Measure stating (CALFED Bay-Delta Program 2000e): before implementing actions that could result in take or the loss or degradation of occupied habitat, conduct surveys in suitable habitat within portions of the species' range that CALFED actions could affect to determine the presence and distribution of the species. The extent of mitigation of direct loss of or indirect impacts on special-status plants will be based on these survey results. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Pre-Construction and design phase

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure VEG-8: Avoid and Minimize Impacts on Special-Status Species and Compensate for Special-Status Species Loss. Any stands of special-status plants found during preconstruction surveys that can be avoided in the construction area will be fenced, including a buffer of 50 feet on all sides. If the special-status plants cannot be avoided, DWR will salvage the plants before the onset of the activities. Salvaged plants will be transplanted immediately to an area of suitable habitat. DWR will initiate mitigation of unavoidable loss of any special-status plants before construction and will base the compensation on the survey results obtained from the preconstruction surveys. The MSCS conservation measure for habitat compensation states, "for each linear foot of occupied habitat lost, create 5 to 10 linear feet of suitable habitat, of equal or higher habitat quality, within 1 year of loss" (CALFED Bay-Delta Program 2000e). Compensation for loss of special-status plants as a result of construction for the Project, therefore, will include creation of new tidal mud flat habitat at a ratio of 5–10 linear feet for each linear foot removed by the Project. The quality of the removed occupied habitat will be evaluated during the preconstruction survey required under Mitigation Measure VEG-7. Low-quality mud flat habitat at the base of levee banks with RSP, for example, would be mitigated at a ratio of 5:1 (5 linear feet created for each linear foot removed), while high-quality mud flat habitat adjacent to emergent wetland and/or riparian vegetation would be mitigated at or near the 10:1 (10 linear feet created for each linear foot removed) mitigation ratio. DWR will identify suitable habitat creation sites that are located as close to the site of plant removal as possible; are areas with minimal boat wakes, shallow water, and slow water velocities; and are not likely to be dredged or have other improvements constructed. Created habitat will have a suitable mud flat substrate at appropriate elevations (approximately 0.5–2 feet NGVD) with minimal disturbance from boat wakes, and levee maintenance. DWR will obtain mitigation site access through a conservation easement or fee title. To the extent practicable, mitigation sites will be located near ongoing or future ERP Projects. If off-site mitigation sites are identified, mitigation will be implemented before the loss of occupied habitat, and salvaged plant material will be planted at the mitigation site. If on-site mitigation	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Pre-construction and design phase

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
sites will be used, salvaged plant material will be stockpiled or propagated at a native plant nursery for planting later, and mitigation will be implemented as soon as practicable after completion of construction activities. If off-site mitigation is necessary, a location that does not currently support tidal flats will be selected. As experimental compensation in additional to the MSCS measure, DWR will prepare a transplanting plan for the special-status plants. As these special-status plants have habitat requirements similar to those described for Mason's lilaeopsis (Golden and Fiedler 1991; Zebell and Fielder 1996), the methods outlined in the monitoring plan for transplanting Mason's lilaeopsis in Barker Slough (California Department of Water Resources 1990b) will be adapted to the special-status plants. The plan will include a success criterion for the transplanted plants to achieve 80% survival at the end of a 5-year monitoring period and additional compensatory measures to implement if the survival rate is not achieved. All unavoidable stands of special-status plants to be removed from the construction area will be salvaged and transplanted to a portion of the created suitable habitat. Areas of occupied habitat will also be considered for enhancement, if transplanting is possible without disturbance of the existing special-status plants. DWR will obtain site access through a conservation easement or fee title. DWR will maintain the transplant areas for a minimum of 5 years, including replanting, removing trash or debris washed onshore, and removing nonnative species, if possible, without disturbing the special-status plants. DWR will monitor the transplanted plants for at least 10 years after transplanting, at 5-year intervals. Monitoring will include measurement of cover of the transplanted plants using large-sized quadrants or, preferably, a transect method. For each monitoring period, DWR and Reclamation will submit a report to DFG describing the results of the monitoring period. The reports will include the monitoring data and a discussion of any problems with the plants and			During and post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
the measures implemented or proposed to correct the problems. The reports will also indicate the annual precipitation and note the occurrence of drought conditions or above-normal flooding events. This information will assist in evaluating whether the transplanted plants have been able to tolerate more than just normal precipitation years. If the monitoring period has coincided with an extended period of drought or high precipitation, DFG may request additional monitoring to measure the response of transplants to a greater range of natural processes.			
4.2 Fisheries and Aquatics			
Mitigation Measure Fish-1: Incorporate Instream Woody Material into Rock Slope Protection at Degraded Levee Sites. To minimize SRA cover losses and reduce habitat fragmentation at degraded levee sites, DWR will incorporate instream woody material into RSP. Instream woody material will consist of multibranched pieces of wood more than 3 feet in length and 2 inches in diameter firmly anchored to shore at an elevation that is mostly submerged at low water levels. This measure will provide woody instream cover to replace, in part, that removed during construction. SRA cover would not be expected to be replaced by natural recruitment at degraded levee sites because RSP is would preclude revegetation at these sites. Site-specific consideration of this mitigation measure will be evaluated to address potential effects on recreation safety both during and after construction. Issues of liability associated with placing material directly in the water column, and hydraulic concerns, may limit the use of this mitigation measure.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	During final design approval and during construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure Fish-2: Quantify and Replace Affected Shaded Riverine Aquatic Cover. Following final project designs and at least 1 year prior to Project construction, DWR will conduct surveys to quantify existing and affected SRA cover (in linear feet and area), including SRA cover supported by existing streamside riparian vegetation and instream woody material and riparian vegetation that currently does not support SRA cover but may support such cover in the future as a result of Project operation (e.g., that resulting from inundation of McCormack-Williamson Tract). For purposes of classification, SRA cover includes terrestrial (e.g., shoreline) and floodplain areas that support riparian vegetation and living or dead vegetation that are inundated during mean high water. In addition, the area of existing SRA cover includes aquatic areas extending from the shoreline to the outermost toward mid-channel) extension of either the vegetative canopy overhanging the water or the living or dead vegetation (Fris and Dehaven 1993). If surveys determine that a net loss in SRA cover will result from construction activities and Project operation, DWR will replace, in association with replanted riparian vegetation (see Mitigation Measure VEG-1), all affected SRA cover by planting riparian vegetation in shoreline and floodplain areas. Candidate SRA cover mitigation areas include terrestrial (e.g., shoreline) and floodplain areas that are inundated during mean high water. Streamside vegetation plantings may also count towards SRA cover if they occur within 15 feet (horizontal distance) of the edge of the wetted channel (i.e., low-flow channel). SRA cover, represented by overhead vegetation and instream woody material in this analysis, is a Resource Category 1. The USFWS's mitigation goal for a Resource Category 1 habitat is no loss of existing habitat quantity or value. DWR will consult with fishery resource agencies (DFG, NMFS, and USFWS), RWQCB, and EBMUD to determine the appropriate candidate SRA cover mitigation areas and replacement ratio for affected SRA cover. Replacement ratios for SRA cover impacts often exceed the affected amount to account for the temporal loss of habitat value while newly replanted vegetation matures. Although on-site mitigation is preferred, off-site mitigation for SRA cover losses may be	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Final Project Design Mitigation Post-Construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
needed to provide full compensation if existing constraints prevent full replacement of affected SRA cover quantities and values in the Project.			
Mitigation Measure Fish-3: Monitor for Fish Stranding and Fill Any Substantial Scour Pools Formed following Large Flood Events That Result in Significant Flooding of McCormack-Williamson Tract. The potential exists for fish, including migratory juvenile fish, to become trapped in scour holes and other depressions that may form on McCormack-Williamson Tract and the Grizzly Slough property during Project operation as floodwaters recede. DWR will monitor McCormack-Williamson Tract and the Grizzly Slough property following flood events that inundate significant portions of the created floodplains to identify areas that may have scoured and that have resulted in fish stranding. If monitoring indicates that fish stranding has occurred, DWR will use appropriate methods (e.g., seining, electrofishing), as authorized, as soon as possible following isolation of the water body to remove stranded fish. Rescued fish will be released to the nearest main channel area. Qualified fish biologists will conduct monitoring and fish rescue operations. To reduce the potential for further fish stranding at locations where scour pools have formed following floodplain inundation, DWR will then use appropriate methods (e.g., grading, rock placement) to fill in new scour holes to reduce their potential to strand fish in the future. Scour areas and depressions that are identified to be potential stranding sites will be filled that year before the beginning of the next winter season.	DWR or its biological contractors. DWR will consult with DFG and/or USFWS.	DWR Project Manager	Post-construction
4.3 Wildlife			
Mitigation Measure WILD-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. The study area is located in and adjacent to habitat that supports nesting birds protected under the MBTA. Protective fencing will be used to protect nesting habitat outside of the construction and maintenance areas. DWR will perform preconstruction surveys to determine whether nesting birds, including migratory birds, raptors, and special-status bird species, are present within or immediately adjacent to the Project sites and associated staging and storage areas.	DWR or its biological contractors in consultation with DFG and/or USFWS will prepare a Floodplain and Shallow Water Tidal Marsh Habitat	DWR Project Manager	Final design, during and after construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Under this Alternative, DWR will remove all woody and herbaceous vegetation from the construction areas during the nonbreeding season for most migratory bird species (September 1–February 1) to minimize effects on nesting birds. During the breeding season, all vegetation will be maintained to a height of approximately 6 inches to minimize the potential for bird nesting. If construction occurs during the breeding season and not all affected vegetation has been removed, a qualified biologist will survey the construction area for active nests and young migratory birds immediately before construction. If active nests or migratory birds are found within the boundaries of the construction area, DWR will develop appropriate measures and will inform DFG of its actions and the potential impacts on these species. Inactive migratory bird nests (excluding raptors) located outside of the construction areas will be preserved. If an inactive migratory bird nest is located in any of these areas, it will be removed before the start of the breeding season (approximately February 1). If an active raptor nest is found outside the construction areas, a buffer zone will be created around the nest tree. The recommended buffer, as identified by DFG, is 250 feet (Sections 3503 and 3503.5 of the California Fish and Game Code). A larger buffer zone will be established around Swainson's hawk nest sites, as described under Mitigation Measure WILD-10: Avoid and Minimize Construction-Related Disturbances within ½ Mile of Active Swainson's Hawk Nest Sites. This mitigation measure is consistent with CALFED Mitigation Measures 1, 2, 5, and 14.	Restoration and Monitoring Plan		
Mitigation Measure WILD-3: Minimize Impacts on Sensitive Biological Resources. DWR will include the following measures to minimize indirect impacts on wildlife and wildlife habitat: 3. DWR will provide an on-site biologist/environmental monitor who will be responsible for monitoring implementation of the conditions in the state and federal permits (CWA Section 401, 402, and 404;	DWR or its biological contractors will implement specified CALFED Programmatic Mitigation Measures 6 and 7. DWR will consult with DFG and/or	DWR Project Manager	Final Design and pre-Construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
ESA Section 7; Fish and Game Code Section 1601; Project plans (SWPPP); and EIS/EIR mitigation measures).	USFWS.		
4. The on-site biologist/environmental monitor will determine the location of environmentally sensitive areas adjacent to each of the Project sites based on existing land cover type and special-status plant species mapping, unless observed field conditions warrant a modification of the environmentally sensitive area boundaries. To avoid construction-phase disturbance of sensitive habitats immediately adjacent to the Project site, the monitor will identify the boundaries and add a 50-foot buffer where feasible with orange construction barrier fencing. The fencing will be mapped on the Project construction drawings. Erosion control fencing also will be placed at the edges of construction where the construction activities are upslope of wetlands and channels to prevent washing of sediments from the construction site into surrounding environmentally sensitive areas. The environmentally sensitive area and erosion-control fencing will be installed before any construction activities are initiated, and it will be maintained throughout the construction period.			
DWR will provide a worker environmental training program for all construction personnel before the start of construction activities. The program will educate workers about special-status species, riparian habitats, and waters of the United States present on and adjacent to the site, and the regulations and penalties for unmitigated effects on these sensitive biological resources.			During construction
Where feasible, construction will avoid and minimize trimming or complete removal of vegetation.			
Following construction, the construction contractor will remove all litter and construction			Post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
debris and implement a revegetation plan for temporarily disturbed vegetation in the construction zones.			
Mitigation Measure WILD-6: Replace Nontidal Wetland Land Cover Types. Impacts on nontidal wetlands would be mitigated by implementation of Mitigation Measure VEG-3, as described in Section 4.1, Vegetation and Wetlands. Where impacts on wetlands cannot be avoided, the area of effect would be kept to the minimum possible. Loss of, or impacts on, these habitats will be compensated for as part of compliance with the state and federal wetland permitting process.	DWR or its biological contractors will ensure design incorporates these features, and that they are included in construction.	DWR Project Manager	During final design approval and during construction
Mitigation Measure WILD-7: Compensate for the Loss of Greater Sandhill Crane Foraging Habitat. Impacts on greater sandhill crane foraging habitat would be mitigated by creating suitable foraging habitat at an off-site conservation area or obtaining a conservation easement of lands that provide suitable foraging habitat for greater sandhill cranes. Agricultural lands may be provided at a ratio of 1:1 or greater, and located on lands that will be preserved and maintained by DWR. The final determination of the mitigation ratio for this state listed as threatened and fully protected species will be determined through DFG's 2081 permitting process. DWR will provide funding for the long-term management and monitoring of these lands and will prepare a monitoring plan for the mitigation site.	DWR or its biological consultant will consult with DFG to determine whether or how surveys are to be performed, conduct any necessary surveys, and if species is detected, develop restoration and relocation plans.	DWR Project Manager	Final design and pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure WILD-8: Perform Preconstruction and Postconstruction Surveys for Elderberry Shrubs. A qualified biologist will perform an elderberry shrub survey before starting construction and sediment disposal activities, and mitigation site implementation to ensure that elderberry shrubs, if present, are identified. The on-site biologist will field stake the locations of elderberry shrubs and shrub clusters before construction begins. Orange exclusion fencing will be installed around each elderberry shrub and shrub cluster. DWR will attempt to perform construction operations without affecting elderberry shrubs and to maintain a 100-foot buffer zone around all elderberry shrubs, to the greatest extent possible. However as a result of the dimensions of the work areas, it is anticipated that work could occur within the 100-foot buffer zone. The surveys will be performed according to the USFWS VELB compensation guidelines (U.S. Fish and Wildlife Service 1999). During the preconstruction and post-construction surveys the following information will be recorded for each shrub or shrub cluster: the number of stems greater than 1 inch in diameter, the number of stems less than 1 inch in diameter, the approximate height and width of the elderberry shrub or shrub cluster, the presence of VELB exit holes, and the dominant vegetation that is associated with the elderberry shrub or shrub cluster. The location of each elderberry shrub or shrub cluster will be mapped using GPS, and a site	DWR or its biological contractors will consult with USFWS to determine whether or how surveys are to be performed, conduct any necessary surveys, and if species is detected, develop restoration and relocation plans.	DWR Project Manager	Pre-construction and post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
map will be prepared identifying the location and size of each shrub and shrub cluster. DWR will use this site map to determine vehicle and equipment haul routes and work areas. Following completion of construction activities, DWR will evaluate the elderberry shrubs to determine whether any shrubs were damaged by Project activities. If damage occurs to elderberry shrubs, DWR will consult with USFWS on appropriate mitigation.			
Mitigation Measure WILD-9: Avoid and Minimize Impacts on Elderberry Shrubs. Wherever feasible, DWR will avoid and minimize Project effects on elderberry shrubs. Avoidance and minimization efforts will be performed according to the USFWS VELB compensation guidelines (U.S. Fish and Wildlife Service 1999). If elderberry shrubs with one or more stems measuring 1 inch or greater in diameter at ground level or plants with visible evidence of exit holes are located within or adjacent to proposed construction areas, DWR will implement the following actions: Install exclusion fencing around each elderberry shrub and shrub cluster. Avoid disturbance to VELB by establishing and maintaining, to the maximum extent feasible, a 100-foot buffer around elderberry plants identified as suitable habitat. If a 100-foot buffer cannot be maintained, DWR will consult and gain approval from the USFWS for measures that would minimize disturbance and promptly restore the damaged area. Fence and flag all buffer areas and place signs every 50 feet along the edge of the avoidance area, as described in the VELB compensation guidelines (U.S. Fish and Wildlife Service 1999). Train construction personnel to recognize elderberry shrubs and to determine the presence of	DWR or its biological contractor will consult with USFWS to determine whether or how surveys are to be performed, conduct any necessary surveys, and if species is detected, develop restoration and relocation plans.	DWR Project Manager	Pre-construction During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
VELB from exit holes on stems. All construction personnel should receive USFWS–approved environmental awareness training before undertaking work at construction sites.			
Mitigation Measure WILD-10: Compensate for Unavoidable Impacts on Elderberry Shrubs. If avoidance and minimization of effects on VELB habitat are not possible, DWR will compensate for unavoidable effects based on the VELB conservation guidelines (U.S. Fish and Wildlife Service 1999). Mitigation efforts may include transplanting elderberry shrubs, planting additional elderberry and associated plant species at an on-site or off-site mitigation area, or purchasing VELB mitigation credits at a USFWS–approved mitigation bank.	DWR will consult with USFWS to determine the level of compensation for unavoidable effects based on VELB conservation guidelines.	DWR Project Manager	Pre-construction and Post-Construction
Mitigation Measure WILD-11: Conduct Preconstruction Surveys for Giant Garter Snake. Preconstruction surveys for giant garter snake will be conducted in all suitable breeding and foraging habitat in the vicinity of Project or mitigation activities to ensure that this species is not present in these locations. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Surveys will be performed during the active period of the snake (May 1–October 1). If surveys must be conducted during the species' inactive period, DWR will contact USFWS to determine whether additional measures are necessary to minimize and avoid take (U.S. Fish and Wildlife Service 1997). Preconstruction surveys will be performed by a qualified biologist within 24-hours of commencement of construction activities. The survey results will be provided to USFWS before starting construction activities.	DWR will consult with USFWS to determine whether or how surveys are to be performed, conduct any necessary surveys, and if species is detected, develop restoration and relocation plans.	DWR Project Manager	Pre-construction
Mitigation Measure WILD-12: Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat. Construction activities could occur throughout the year and would overlap the giant garter snake active and inactive periods. To the greatest extent practicable, major construction activities that could affect giant garter snake breeding and foraging habitat will be avoided during the active period. If Project construction activities necessitate dewatering wetland	DWR will consult with USFWS to determine whether or how surveys are to be performed, conduct any necessary surveys, and if species is detected, develop	DWR Project Manager	Pre-construction During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
habitat during the snake's active period, that habitat will remain dry for at least 15 consecutive days before excavation or refilling (U.S. Fish and Wildlife Service 1997). If construction activities will be conducted during the species' inactive period, DWR will contact USFWS to determine whether additional measures are necessary to minimize and avoid take. Clearing of wetland vegetation will be confined to the minimal area necessary to complete the desired activities. The movement of heavy equipment will be restricted to established roadways or constructed haul roads to minimize habitat disturbance.	restoration and relocation plans.		
Mitigation Measure WILD-13: Perform Preconstruction Surveys for Nesting Swainson's Hawks before Construction and Maintenance. Preconstruction surveys for Swainson's hawk will be conducted at and adjacent to all locations to be disturbed by construction to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Preconstruction surveys will consist of surveying all potential nest sites within ½ mile of proposed construction features, borrow sites, and mitigation sites. Surveys will be performed several times during the breeding season to avoid and minimize effects on late-nesting birds. Nest sites will be marked on an aerial photograph, and the position will be recorded using GPS.	DWR or its biological consultant will coordinate with DFG in conducting pre-construction surveys at and adjacent to adjacent to all locations to be disturbed by construction. DWR shall consult with DFG to determine amount and location of off-site mitigation land, and DWR will purchase andprotect said lands.	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
MITIGATION MEASURE WILD-14: AVOID AND MINIMIZE CONSTRUCTION-RELATED DISTURBANCES WITHIN ½ MILE OF ACTIVE SWAINSON'S HAWK NEST SITES. Construction would occur throughout the year and would overlap with the Swainson's hawk breeding season. To the greatest extent practicable, major construction activities that would occur within ½ mile of an active Swainson's hawk nest should be avoided during the breeding season. If practicable, construction activities that would result in the greatest disturbance to an active nest site will be deferred until after or as late in the breeding season as possible. DWR will notify DFG of the locations of active nest sites identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis. DFG requires that a ½-mile buffer be established around all active Swainson's hawk nests between March 1 and August 15 (California Department of Fish and Game 1994). Potential nesting trees within the construction footprint will be removed before construction and before nesting by individual pairs is initiated. Potential nest trees outside the construction footprint will be retained. Vegetation will be removed before the nesting season for migratory birds and Swainson's hawk (i.e., removal will occur between September 1 and February 1). Because of the relatively narrow width of the Project area and the location and dimensions of the proposed work areas and access roads to riparian vegetation that currently provide nesting habitat for Swainson's hawks, a ½-mile buffer may not be feasible in all areas. DWR will maximize the buffer width around active nest sites on a site-by-site basis and will consult with DFG on the buffer widths before initiating construction-related activities. If possible, DWR will delay construction and maintenance around individual raptor nests until after the young have fledged. DWR will immediately cease work and contact DFG if a young bird has prematurely fledged the nest as a result of construction or maintenance activities.	DWR will incorporate tree protection in its design; project construction supervisors will be informed of tree protection measures. DWR will maximize the buffer width around active nest sites on a site-by-site basis and will consult with DFG on the buffer widths before initiating construction-related activities.	DWR Project Manager	Current and on-going During construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure WILD-15: Replace or Compensate for the Loss of Swainson's Hawk Foraging Habitat. Based on the presence of suitable habitat, it is assumed that construction activities will occur within ½ mile of active nest sites. As a result, DWR will compensate for foraging habitat at one of the following ratios (California Department of Fish and Game 1994): provide 1 acre of suitable foraging habitat (e.g.; Habitat Management [HM] lands) for each acre of affected habitat (1:1 ratio)— at least 10% of these lands will include a fee title acquisition or conservation easement allowing for active management of the land to manage for active prey production, and the remaining 90% of the HM lands will be protected by a conservation easement on agricultural or other lands that provide suitable foraging habitat for Swainson's hawks; or provide ½ acre of HM land, with a fee title acquisition or conservation easement allowing for active management of the land to manage for active prey production (0.5:1 ratio). DWR will also provide funding to ensure that these lands will be managed to provide Swainson's hawk foraging habitat. This funding will consist of a site management endowment at a rate to be determined by DFG.	DWR shall consult with DFG to determine amount and location of off-site mitigation land, and DWR will purchase and protect said lands.	DWR Project Manager	Pre-construction and during construction
Mitigation Measure WILD-17: Conduct Preconstruction Surveys for Burrowing Owls. Preconstruction surveys for western burrowing owls will be conducted at and adjacent to all locations to be disturbed by construction to ensure that this species is not nesting or roosting in these locations. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Preconstruction surveys will be performed according to the DFG guidelines for this species (California Department of Fish and Game 1995b). Surveys will	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with	DWR Project Manager	Current and on-going Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
consist of surveying all suitable nesting and roosting habitat within 500 feet of proposed construction features, deposition areas, and mitigation sites, as well as along all haul roads located on levees or at the toe of the levees. Surveys will be conducted during both the wintering and nesting seasons, unless the species is detected during the first survey. The winter survey will be conducted between December 1 and January 31 (if possible). Nesting surveys will be conducted between April 15 and July 15 to correspond with the peak of the breeding season. Surveys will be performed in the early morning and evening as specified in the DFG guidelines. Pedestrian survey transects will be spaced to provide 100% visual coverage of the ground surface. Disturbance of occupied burrows during the surveys will be avoided to the greatest extent practicable. In addition to the seasonal surveys, a preconstruction survey will be conducted within 30 days before construction to ensure that no additional owls have established territories since the initial surveys.	DFG.		
Mitigation Measure WILD-18: Minimize Construction-Related Disturbances near Occupied Nest Sites. Burrowing owls may use the nest burrows as roosting sites throughout the year or may move into other burrows not used for nesting outside of the breeding season. Major construction activities that would result in the greatest disturbance to an active nest or roost sites will be deferred until after or as late in the breeding season as possible. The following activities are considered impacts on western burrowing owls (California Department of Fish and Game 1995b): disturbance within approximately 160 feet (50 meters), which may result in harassment of owls at occupied burrows;	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with DFG.	DWR Program Manager	Current and on-going Pre-construction and during construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
destruction of natural and artificial burrows; and destruction or degradation of foraging habitat within 330 feet (100 meters) of an occupied burrow. DWR will notify DFG of the locations of occupied burrows identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.			
Mitigation Measure WILD-19: Avoid or Minimize Disturbance to Active Nest and Roost Sites. If practicable, active nest and roost sites will be avoided during Project implementation. To avoid impacts during the nonbreeding season (September 1–January 31), no activities should occur within 160 feet of occupied burrows. To avoid impacts during the breeding season (February 1–August 31) no activities should occur within 250 feet of occupied burrows. Avoidance of occupied burrows also requires that a minimum of 6.5 acres of foraging habitat be permanently preserved around each occupied burrow (California Department of Fish and Game 1995b). If active burrows are identified during the preconstruction surveys, DWR will coordinate with DFG to identify the appropriate avoidance and minimization measures and to determine the configuration of the foraging habitat to be permanently preserved.	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with DFG.	DWR Program Manager	Current and on-going Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure WILD-20: Create New or Enhance Existing Suitable Burrows. If the destruction of occupied burrows is unavoidable, existing unsuitable burrows will be enhanced or new, artificial burrows will be created in accordance with the DFG guidelines (California Department of Fish and Game 1995b). New or enhanced burrows will be provided at a ratio of 2:1 and located on lands that will be preserved and maintained by DWR. DWR will provide funding for the long-term management and monitoring of these lands and will prepare a monitoring plan for the burrowing owl mitigation site. Passive relocation techniques will be used to clear burrowing owls from occupied burrows. These techniques are described in the DFG guidelines for this species. Passive relocation techniques and artificial burrow designs will be approved by DFG before implementing this mitigation measure. Passive relocation will not be allowed until after the breeding season if it is determined that eggs or nestlings are present.	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with DFG.	DWR Program Manager	Current and on-going Pre-construction
Mitigation Measure WILD-21: Replace Lost Burrowing Owl Foraging Habitat. If it is determined that occupied burrows are present in the Project area, DWR will mitigate the loss or disturbance of foraging habitat by implementing the following measures: 1. Permanently preserve 6.5 acres of foraging habitat around each occupied burrow that is avoided. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG. 2. Permanently preserve 6.5 acres of foraging habitat around each newly constructed or enhanced burrow. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG.	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with DFG.	DWR Program Manager	Current and on-going Pre-construction During or

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Based on the preconstruction survey results, DWR will avoid and minimize impacts on burrowing owls and acquire, protect, or manage suitable burrowing owl foraging habitat in the Project vicinity or, pending approval of DFG, purchase mitigation or conservation bank credits at an approved bank.			post-construction
Mitigation Measure WILD-21: Replace Lost Burrowing Owl Foraging Habitat. If it is determined that occupied burrows are present in the Project area, DWR will mitigate the loss or disturbance of foraging habitat by implementing the following measures: 1. Permanently preserve 6.5 acres of foraging habitat around each occupied burrow that is avoided. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG. 2. Permanently preserve 6.5 acres of foraging habitat around each newly constructed or enhanced burrow. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG. Based on the preconstruction survey results, DWR will avoid and minimize impacts on burrowing owls and acquire, protect, or manage suitable burrowing owl foraging habitat in the Project vicinity or, pending approval of DFG, purchase mitigation or conservation bank credits at an approved bank.	DWR or its biological consultants will conduct surveys. If burrowing owls are confirmed, DWR will mitigate as determined in consultation with DFG.	DWR Program Manager	Current and on-going Pre-construction During or post construction
Mitigation Measure WILD-22: Avoid and Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat. Western pond turtles are known to occur in the waterways of the Project area and are expected	DWR will conduct habitat assessment, consult with USFWS and DFG, assure project phasing is	DWR Project Manager	Pre-construction and during construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
to occur in suitable off-channel habitats. Because these waterways are large, open systems, it is not feasible to clear and permanently exclude all western pond turtles from the construction sites. A qualified biologist will conduct preconstruction surveys to determine the approximate population density of turtles in the construction areas. Where practical, DWR will install sheet piles, cofferdams, or other measures to minimize sedimentation between the in-channel construction zones and adjacent waterways. This system would minimize the degradation of aquatic habitats outside the construction zone and inhibit the movement of some turtles into the construction zone. Turtles found in the work area will be captured and transported to a nearby location outside of the work area. To avoid the loss of western pond turtle and eggs as a result of construction, DWR will install plastic orange mesh exclusion fencing or silt exclusion fencing on the channel banks to prevent turtles from nesting in the work areas. The fencing will be installed to a depth of 6 inches below the ground surface to prevent turtles from going under the fence. Fences will be installed before the nesting season (i.e., March 1) and will remain in place through August. The fencing may be removed before grading. An on-site biologist will be present during all in-channel activities to relocate western pond turtles outside of the construction zones.	appropriate, and assure that large woody debris are placed.		
Mitigation Measure WILD-23: Conduct Preconstruction Surveys for Tricolored Blackbird. Preconstruction surveys for tricolored blackbird nesting colonies will be conducted at and adjacent to all locations to be disturbed by construction to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Preconstruction surveys will consist of surveying all suitable breeding habitat in the vicinity of Project or mitigation activities. Pedestrian survey transects will be used to provide 100% visual coverage of the suitable breeding habitat. Nest colony surveys are recommended to	DWR shall consult with DFG to determine amount and location of off-site mitigation land, and DWR will purchase and protect said lands.	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
begin at the end of April with subsequent surveys occurring throughout the breeding season (Beedy and Hamilton 1997). If a nesting colony is observed, the location will be marked on an aerial photograph, and the position will be recorded using GPS.			
Mitigation Measure WILD-24: Minimize Construction-Related Disturbances in the Vicinity of Active Tricolored Blackbird Colonies. Portions of the construction would occur throughout the year and would overlap the tricolored blackbird breeding season (mid-April–July). To the greatest extent practicable, major construction activities that occur within ¼ mile of tricolored blackbird nest sites will be avoided during the breeding season. If practicable, construction that would result in the greatest disturbance to an active nest sites will be deferred until after or as late in the breeding season as possible. DWR will notify DFG of the locations of active nest sites identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.	DWR shall consult with DFG to determine amount and location of off-site mitigation land, and DWR will purchase and protect said lands. DWR will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.	DWR Project Manager	Pre-construction and during construction
Mitigation Measure WILD-25: Conduct Preconstruction Surveys for California Black Rail. Preconstruction surveys for California black rail will be conducted at and adjacent to all locations to be disturbed by construction to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Preconstruction surveys will consist of surveying all suitable breeding habitat in the vicinity of Project or mitigation activities. Surveys will be performed to record species presence and density and abundance. Surveys will be performed in all tidal emergent wetlands that are greater than 1.2 acres (0.5 hectare) in total area and have shallow water or moist soil conditions (Arizona Game and Fish Department 2002). Fixed, permanent survey points will be selected and marked in the field and by using a GPS receiver. Surveys will be performed several times during the breeding season to avoid and minimize effects on late nesting birds. The surveys will be performed during periods of	DWR will conduct surveys to record species presence and density and abundance. DWR will consult with DFG to minimize or avoid impacts. DWR will manage water to discourage habitat use by black rails prior to habitat inundation or ground disturbance.	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
good weather (e.g., clear to cloudy skies, no precipitation, minimal wind). The survey points will be surveyed in either the early morning or evening. Morning surveys will begin within 30 minutes of sunrise and will be completed within 4 hours after sunrise. Evening surveys will begin 4 hours before sunset and be completed before dark (Arizona Game and Fish Department 2002). A recording of a black rail call will be played at varying intervals and records of responses will be recorded. The playback interval will follow the guidelines identified in the black rail monitoring protocol (Arizona Game and Fish Department 2002). If a response is heard, the location will be marked on an aerial photograph, and the position will be recorded using GPS.			
Mitigation Measure WILD-26: Minimize Construction-Related Disturbances in the Vicinity of Active California Black Rail Nest Sites. Portions of the construction activities would occur throughout the year and would overlap the California black rail breeding season (mid-March–July). To the greatest extent practicable, major construction activities that would be near expected California black rail nest sites will be avoided during the breeding season. If practicable, construction activities that would result in the greatest disturbance to an active nest site will be deferred until after or as late in the breeding season as possible. DWR will notify DFG of active nest sites identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.	DWR will notify DFG of active nest sites identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.	DWR Program Manager	Pre-construction and during construction
Mitigation Measure WILD-27: Conduct Preconstruction Surveys to Locate Rookeries. Preconstruction surveys for rookeries will be conducted at and adjacent to all locations to be disturbed by construction. Surveys will also be performed at all mitigation sites before implementation of the mitigation features. Preconstruction surveys will consist of surveying all potential nest sites within ¼ mile of proposed construction features, and mitigation sites. Surveys will be performed several times during the breeding season to avoid and minimize impacts on late-nesting birds. Rookery locations will be marked on an aerial photograph, and the position will be recorded using GPS. Preconstruction survey data will be used in	DWR in consultation with DFG will conduct preconstruction surveys for rookeries will be conducted at and adjacent to all locations to be disturbed by construction.	DWR Program Manager	Pre-construction and during construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
accordance with conservation measures listed below.			
Mitigation Measure WILD-28: Minimize Construction-Related Disturbances within ¼ Mile of Active Rookeries. Portions of the construction activities will occur throughout the year and will overlap with the breeding season. To the greatest extent practicable, major construction activities that will occur within ¼ mile of an active rookery will be avoided during the breeding season. If practicable, construction activities that would result in the greatest disturbance to an active rookery will be deferred until after or as late in the breeding season as possible. DWR will notify DFG of the locations of active rookeries identified during the preconstruction surveys and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.	DWR in consultation with DFG will conduct preconstruction surveys for rookeries will be conducted at and adjacent to all locations to be disturbed by construction.	DWR Program Manager	Pre-construction and during construction
Mitigation Measure WILD-30: Replace Lost Breeding Habitat. DWR will compensate for the unavoidable loss of riparian habitat caused by Project implementation by restoring or enhancing in-kind riparian and valley oak habitat. This compensation will restore or enhance in-kind habitat at a ratio of 3 acres for each acre affected, as described in the mitigation measures for riparian habitat in Section 5.1.	DWR will compensate for the unavoidable loss of riparian habitat caused by Project implementation by restoring or enhancing in-kind riparian and valley oak habitat.	DWR Project Manager	Post-construction
Mitigation Measure WILD-31: Conduct Preconstruction Surveys for Bats. A qualified biologist will conduct acoustic and visual surveys for bats one or two times between April and August before construction begins. The biologist should determine whether the structures and bridges to be removed are being used as day, night, and/or maternal roost. If large trees and structures are to be removed prior to the end of the maternity season (late August), they will be surveyed for exit flights in order to be sure that roosting bats will not be harmed in tree or structure removal. If any special-status bat species are discovered roosting on the structures or the bridges, work on the bridges should be avoided until after migration in	DWR will ensure that any occupied trees or structures are removed only when bats are absent or least likely to be affected.	DWR Project Manager	Pre-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
late fall when bats are less likely to be roosting in these areas. Removal of existing structures and work on the bridges should begin during late fall or winter (November 1–March 1). The biologist should confirm that the bats have vacated the work areas before the start of construction activities. If construction during this time period is not possible, the biologist will consult with DFG to determine appropriate mitigation measures, which may include constructing and placing bat boxes near the bridge or exclusion of bats from the bridge through accepted means. Implementation of these measures would prevent injury and mortality of special-status bats and other bat species.			
5.1 Land Use, Recreation, and Economics			
Mitigation Measure LU-1: Project Features for Farmland Protection **Conservation Easement Agreement on Staten Island to ensure protection of agricultural land within the Project Area.** Staten Island was acquired by TNC (as a third-party landholder) in October 2001 with DWR funds, specifically for the purposes of the North Delta Project and in cooperation with CalFED. Although this Project originated from the CalFED program, it is being implemented independently with DWR as the lead agency. As a component of the funds provided by DWR, TNC entered into an agreement providing DWR with an exclusive and perpetual conservation easement covering the entire property. The purpose of this easement is to protect the following multiple and complementary benefits: agricultural land preservation, including the economic viability of agricultural operations; wildlife habitat protection; protection of a floodplain area from potential inappropriate and incompatible development; and potential role in future flood management and water management improvements (the North Delta Project).	DWR or TNC will continue to manage Staten Island in accordance with the Conservation Easement Agreement.	DWR Project Manager	Current and ongoing

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
These multiple and complementary benefits are preserved under the easement agreement: Whereas, Grantor [TNC] and the Department [DWR] further acknowledge that the Department is engaging in a multi-agency planning process for designing and constructing floodway improvements in the North Delta (the "North Delta Planning Process"), pursuant to the CALFED Bay-Delta Program Programmatic Record of Decision (August 28, 2000). The Department's evaluation of alternatives for such floodway improvements in the North Delta may include use of all or a portion of Staten Island for future flood management projects or activities. The stipulations specified in the easement agreement provide protection for the approximately 8400 acres of Staten Island farmland. This in combination with the flood protection benefits provided by the Project for several thousand acres of surrounding (adjacent to Staten Island and McCormack-Williamson Tract) farmland, will result in a net benefit to agriculture within the Project Area. **Continue Agricultural Practices on McCormack-Williamson Tract and the Grizzly Slough Property.** DWR may consider managing McCormack-Williamson Tract and the Grizzly Slough property to support wildlife-friendly agricultural practices. Floodplain habitat and agriculture are often compatible land uses, and similar management efforts in the Yolo Bypass have proven successful. For example, grazing could be used not only to keep the land in agricultural production, but also to control invasive vegetation. **Flood protection for surrounding farmland in project area.** Implementation of the project will provide an overall net benefit for agriculture by providing additional flood protection for surrounding farmland in the project area.	DWR may implement agricultural practices on Grizzly Slough and DWR and TNC may implement agricultural practices on McCormack-Williamson Tract in conjunction with the flood protection and ecosystem restoration actions.	DWR Project Manager	Final design and during construction Post-construction

Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
5.6 Public Health and Environmental Hazards			
Mitigation Measure PH-1: Properly Dispose of Contaminated Materials. If evidence of contaminated materials is encountered during construction, construction will cease immediately and applicable requirements of the CERCLA and the California Code of Regulations (CCR) Title 22 regarding the disposal of waste will be implemented. In addition, a contingency plan will be prepared to address the actions that will be taken during construction in the event that unexpected contaminated soil or groundwater is discovered. The plan will include health and safety considerations, instructions on handling and disposal of wastes, reporting requirements, and emergency procedures.	DWR, or its construction monitor will develop a contingency plan to address the actions to be taken should contaminated groundwater or soil is discovered.	DWR Project Manager	During Construction
5.7 Cultural Resources			
Mitigation Measure CR-1: DESTRUCTION OF ARCHEOLOGICAL SITES . Several mitigation strategies listed in the August 2000 CALFED Programmatic ROD are feasible mitigation measures for impacts incurred on P-39-324, P-39-4419, and P-39-4420, namely mitigation strategies 3–5 and 7–8. Prior to approval and final design of the downstream levee modifications, DWR will authorize qualified archaeologists to map the sites (mitigation strategy 3), conduct surface collections and perform test excavations at the sites (mitigation strategies 4 and 5), and prepare a report to document the results of mitigation strategies 3–5 above (mitigation strategy 7). Based on the findings of these mitigation strategies, DWR will determine whether the sites are historical resources or unique archaeological resources for the purposes of CEQA, or are not significant cultural resources. If DWR determines the sites to be non-significant, no additional mitigation is required, and this impact will be reduced to a less-than-significant level. Conversely, if DWR determines that the any or all of the sites qualify as historical resources or unique archaeological resources, DWR will authorize qualified archaeologists to conduct full-scale excavations of the site(s) deemed significant (mitigation strategy 8), prepare public interpretive documents (mitigation strategy 9), and prepare a report to document mitigation work (mitigation strategy 7), as appropriate to the	DWR, or its construction monitor, will authorize qualified archaeologists to map the sites, conduct surface collections, and prepare a report to document the results. The report shall also include cultural resource protection measures in educational sessions, and ensure that this measure is followed.	DWR Project Manager	Pre-construction During Construction

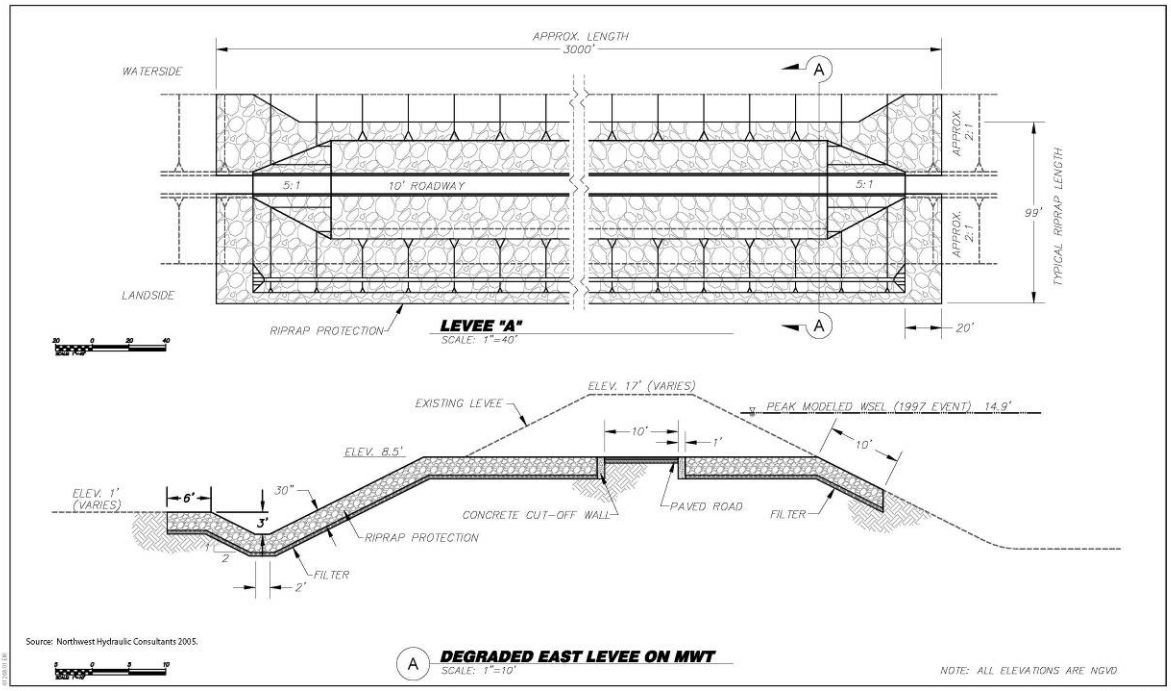
Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
qualities of the sites.			
Mitigation Measure CR-2: Destruction of Unevaluated Isolated Finds Mitigation strategies 1 and 3, listed in the August 2000 CALFED Programmatic ROD, are feasible mitigation measures for impacts incurred on P-39-4421, P-39-4427, P-39-4428, P-39-4429, and P-39-4438. Prior to approval and final design of the downstream levee modifications, DWR will authorize qualified archaeologists to survey the isolate vicinities and map all archaeological materials identified to determine whether additional archaeological materials are present. If no additional archaeological materials are present, isolates P-39-4421, P-39-4427, P-39-4428, P-39-4429, and P-39-4438 would not qualify as historical resources or unique archaeological resources for the purposes of CEQA, and implementation of mitigation measures 1 and 3 would reduce this impact to a no-impact level. If additional archaeological materials are identified at any or all of the isolated finds, they will be considered archaeological sites and DWR will authorize qualified archaeologists to conduct surface collections and perform test excavations at the sites (mitigation strategies 4 and 5), and prepare a report to document the results of mitigation strategies 3–5 above (mitigation strategy 7). Based on the findings of these mitigation strategies, DWR will determine whether the sites are historical resources or unique archaeological resources for the purposes of CEQA, or are not significant cultural resources. If DWR determines the sites to be non-significant, no additional mitigation is required and this impact will be reduced to a less-than-significant level. Conversely, if DWR determines that the any or all of the sites qualify as historical resources or unique archaeological resources, DWR will authorize qualified archaeologists to conduct full-scale excavations of the site(s) deemed significant (mitigation strategy 8), prepare public interpretive documents (mitigation strategy 9), and prepare a report to document mitigation work (mitigation strategy 7), as appropriate to the qualities of the sites.	DWR, or its construction monitor, will authorize qualified archaeologists to map the sites, conduct surface collections, and prepare a report to document the results. The report shall also include cultural resource protection measures in educational sessions, and ensure that this measure is followed.	DWR Project Manager	Pre-construction During Construction

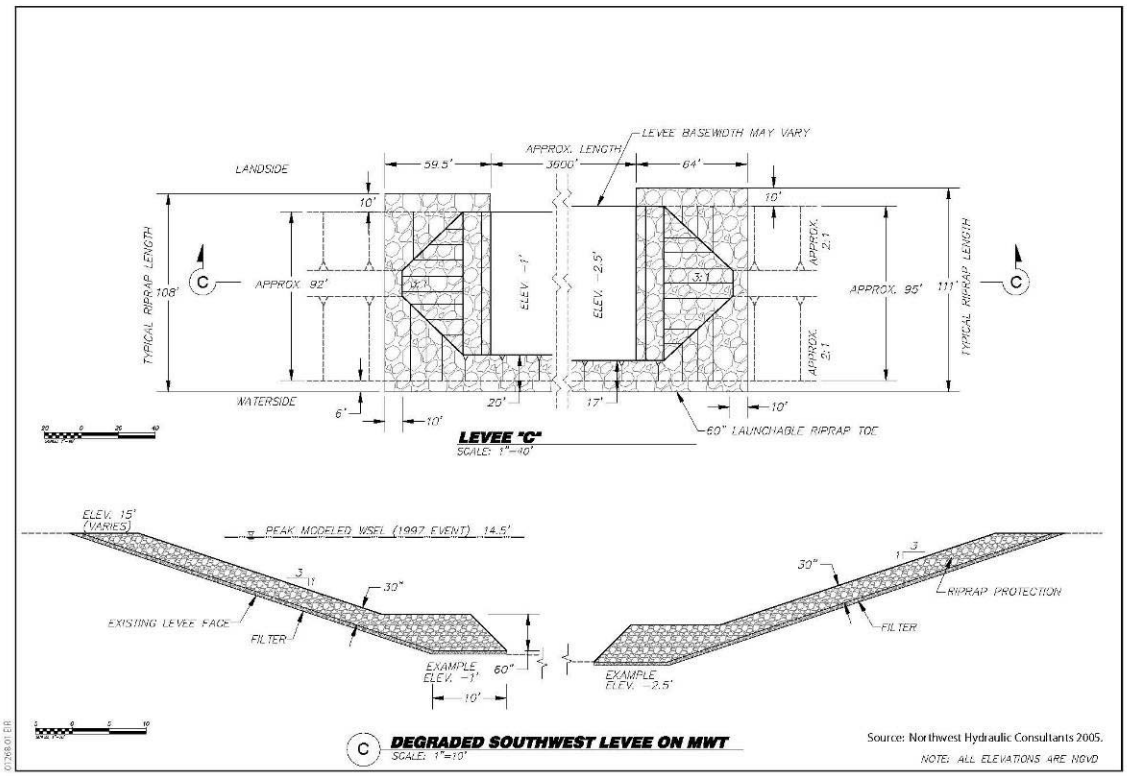
Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
Mitigation Measure CR-3: Destruction of Cultural Resources along Unexamined Portions of the Downstream Levees Because the progress in defining this project action is provisional, mitigation strategies 1 and 7 listed in the August 2000 CALFED Programmatic ROD, are feasible mitigation measures for this impact, provided no cultural resources are identified as a result. Prior to approval and final design of the downstream levee modifications, DWR will authorize qualified cultural resource specialists to survey the areas slated for improvements (mitigation strategy 1). If no cultural resources are identified in the improvement areas, implementation of mitigation strategies 1 and 7 (report preparation) will reduce this impact to a no-impact level. If archaeological resources are identified as a result of survey work, DWR will authorize qualified archaeologists to conduct surface collections and perform test excavations at the sites (mitigation strategies 4 and 5) and prepare a report to document the results of mitigation strategies 3–5 above (mitigation strategy 7). Based on the findings of these mitigation strategies, DWR will determine whether the sites are historical resources or unique archaeological resources for the purposes of CEQA, or are not significant cultural resources. If DWR determines the sites to be non-significant, no additional mitigation is required and this impact will be reduced to a less-than-significant level. Conversely, if DWR determines that the any or all of the sites qualify as historical resources or unique archaeological resources, DWR will authorize qualified archaeologists to conduct full-scale excavations of the site(s) deemed significant (mitigation strategy 8), prepare public interpretive documents (mitigation strategy 9), and prepare a report to document mitigation work (mitigation strategy 7), as appropriate to the qualities of the sites. If historic architectural resources are identified as a result of survey work, DWR will authorize qualified architectural historians to conduct an oral history research to determine, in consultation with DWR, whether the resources constitute historical resources for the purposes of CEQA. The results will be documented in an evaluation report (mitigation strategy 7).	DWR, or its construction monitor, will authorize qualified archaeologists to map the sites, conduct surface collections, and prepare a report to document the results. The report shall also include cultural resource protection measures in educational sessions, and ensure that this measure is followed.	DWR Project Manager	Pre-construction

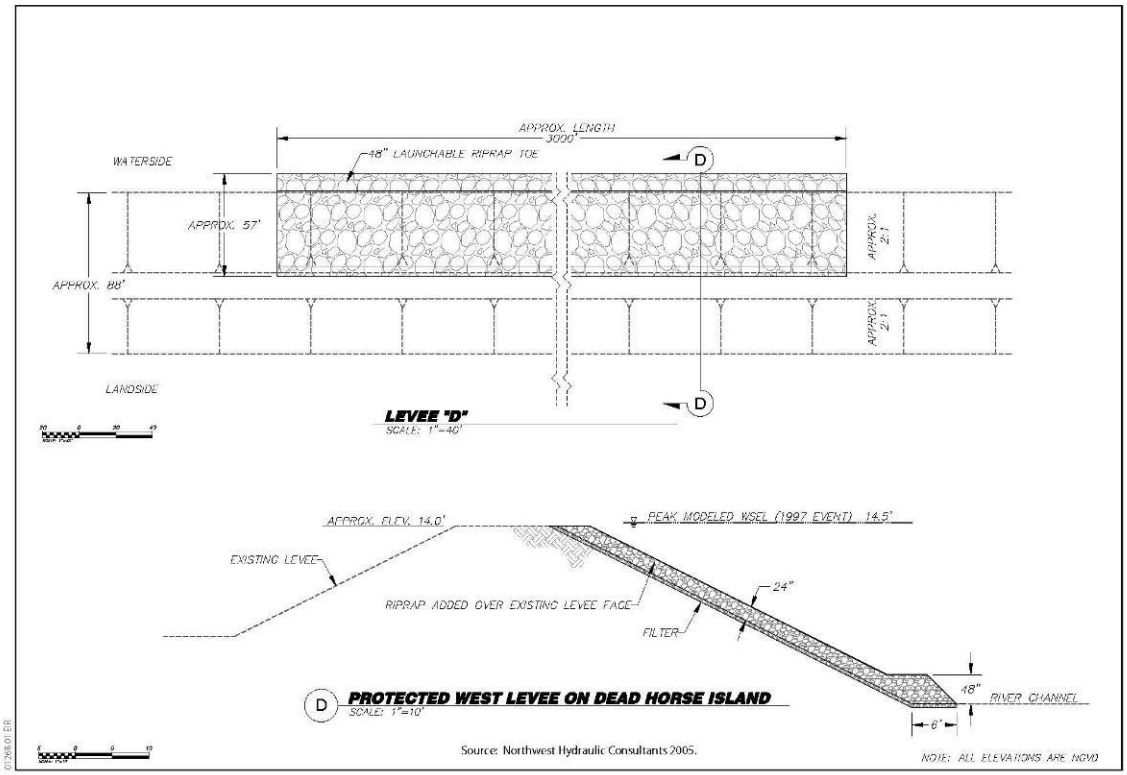
Mitigation	*Implementing Responsibility*	*Monitoring Responsibility*	*Mitigation Timing*
If DWR determines the historic architectural resources to be historical resources for the purposes of CEQA, DWR will authorize qualified architectural historians to document historic structures by preparing Historic American Engineering Records of Historic American Building Surveys (mitigation strategy 10), prepare public interpretive documents (mitigation strategy 9), and prepare mitigation reports (mitigation strategy 7). Options for avoidance through project design should be contemplated as well (mitigation strategy 2).			
Mitigation Measure CR-4: Destruction of Cultural Resources along Unexamined Portions of the Downstream Levees Two mitigation strategies listed in the August 2000 CALFED Programmatic ROD are feasible mitigation measures for impacts incurred on P-34-37, namely mitigation strategies 2 and 3. Prior to approval and final design of the grading of the proposed borrow site, DWR will authorize qualified archaeologists to map the site (mitigation strategy 3) and fence the site boundaries for avoidance during construction (mitigation strategy 2). DWR should task a qualified archaeologist with periodic examinations of the fencing to ensure that the barrier is not crossed and clearly delimits the site boundaries throughout the duration of grading.	DWR, or its construction monitor, will will authorize qualified archaeologists to map the sites, conduct surface collections, and prepare a report to document the results. The report shall also include cultural resource protection measures in educational sessions, and ensure that this measure is followed.	DWR Project Manager	Pre-construction During Construction

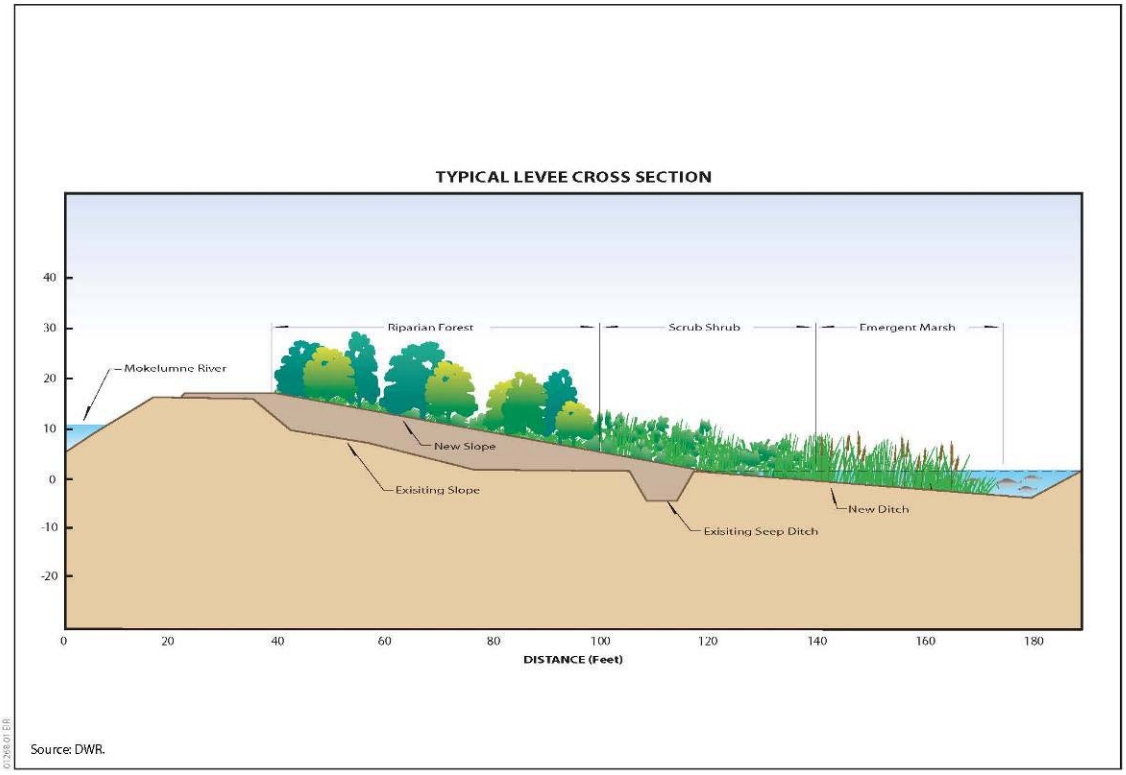
Appendix B: Project Design

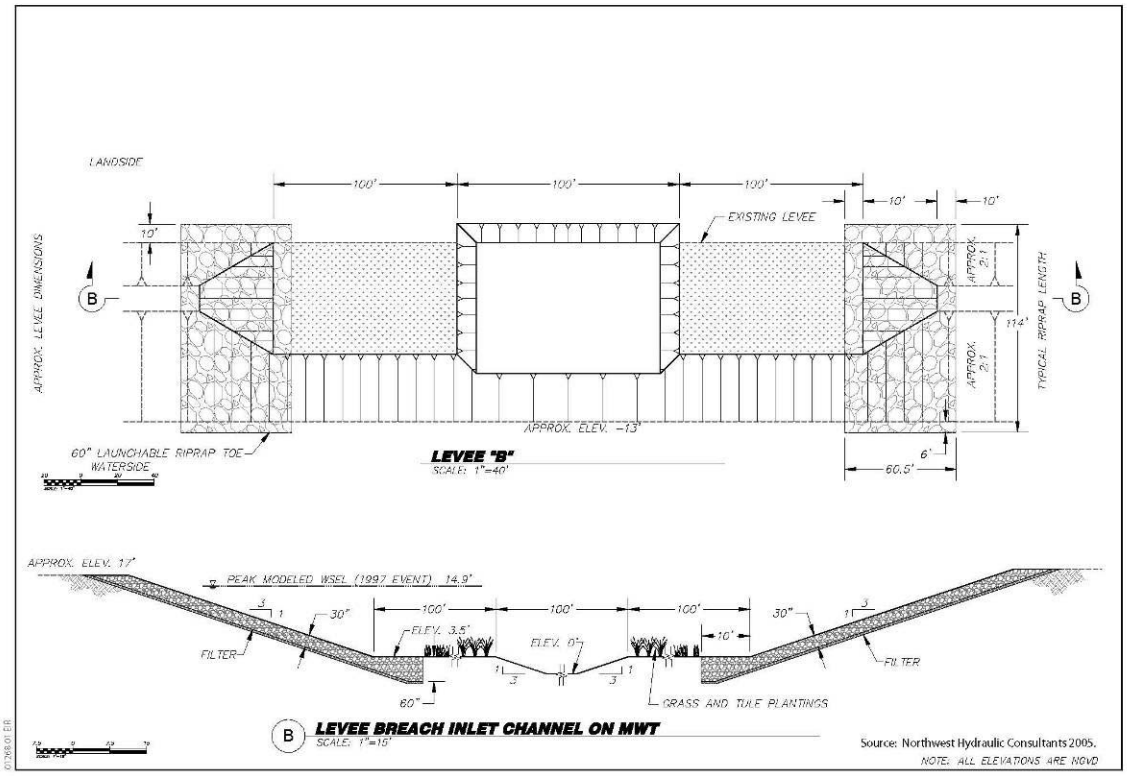
(From the North Delta Flood Control and Ecosystem Restoration Project EIR, Volume 2)

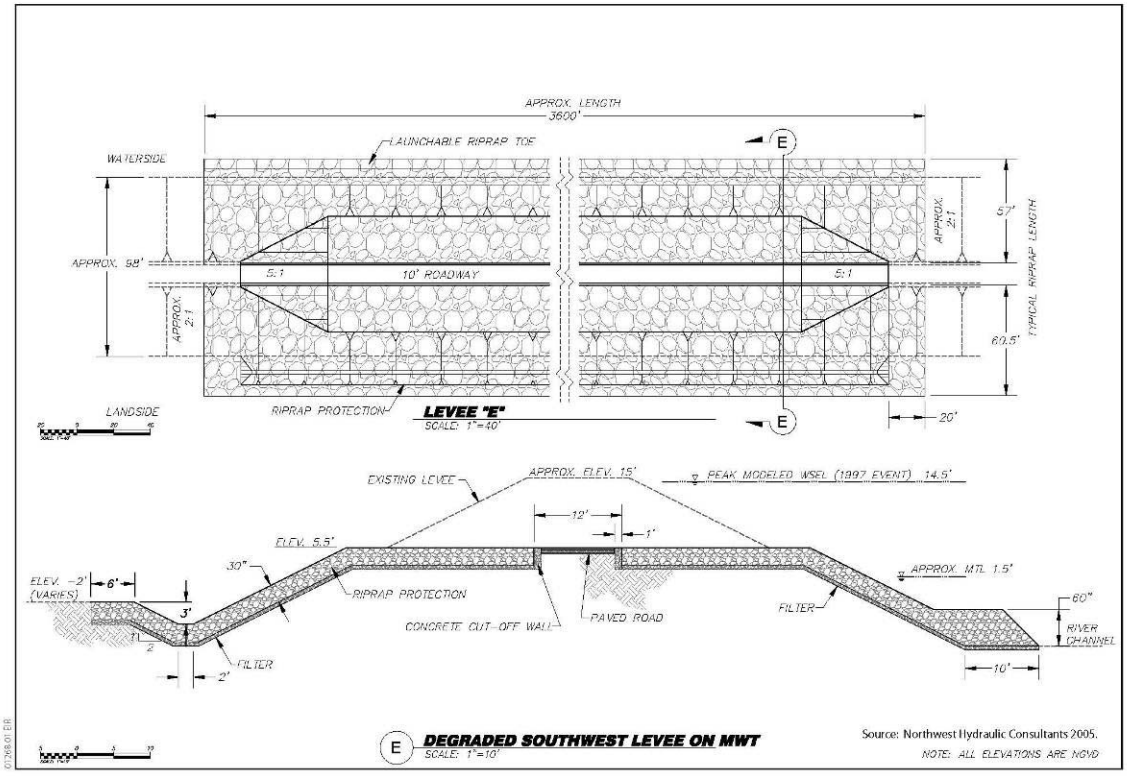


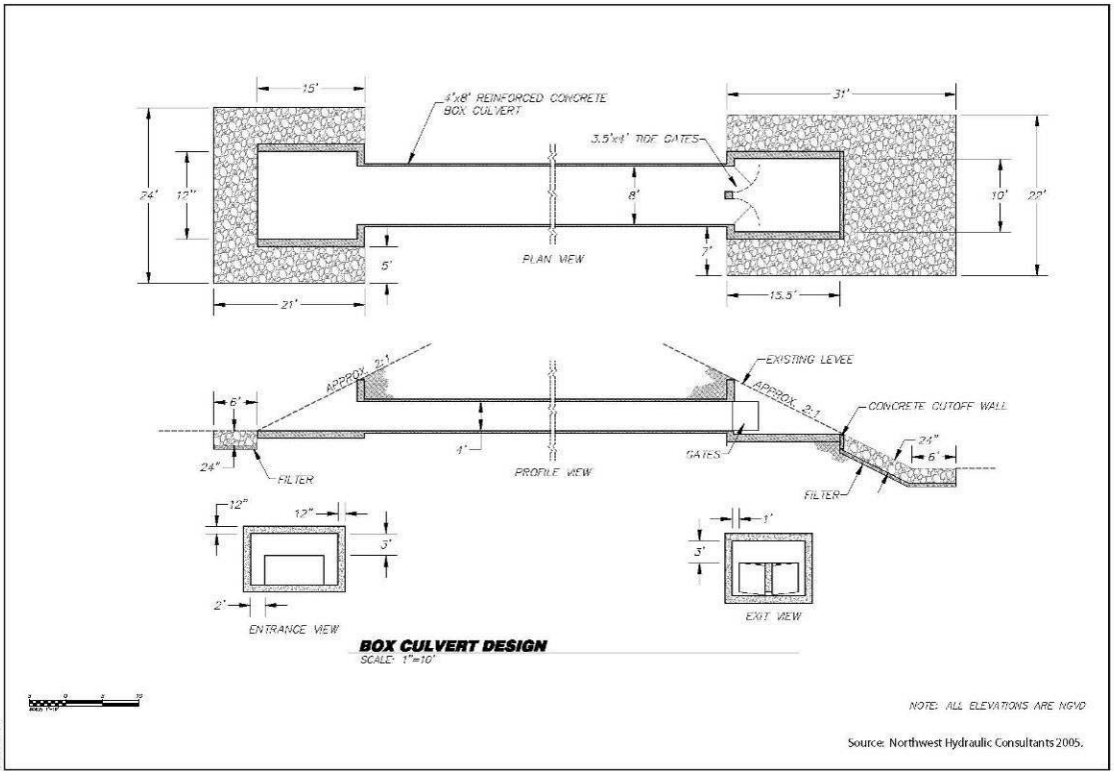


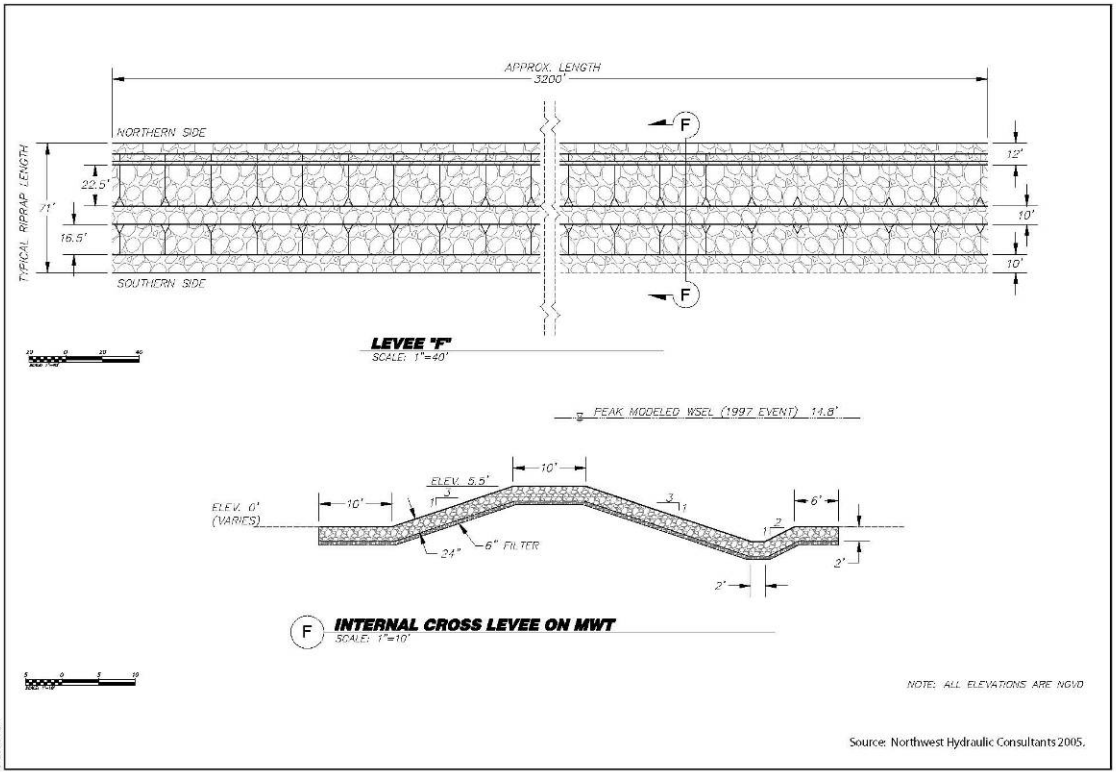

APPROX. LENGTH
3000'
48" LAUNCHABLE RIPRAP TOE
WATERSIDE
APPROX. 57'
APPROX. 88'
APPROX. 2:1
APPROX. 2:1
LANDSIDE
LEVEE "D"
SCALE: 1"=40'
APPROX. ELEV. 14.0'
PEAK MODELED WSEL (1997 EVENT) 14.5'
EXISTING LEVEE
RIPRAP ADDED OVER EXISTING LEVEE FACE
24"
FILTER
18"
RIVER CHANNEL
6'
PROTECTED WEST LEVEE ON DEAD HORSE ISLAND
SCALE: 1"=10'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


TYPICAL LEVEE CROSS SECTION
Riparian Forest
Scrub Shrub
Emergent Marsh
Mokelumne River
New Slope
Exisiting Slope
New Ditch
Exisiting Seep Ditch
40
30
20
10
0
-10
-20
0
20
40
60
80
100
120
140
160
180
DISTANCE (Feet)
Source: DWR.


LANDSIDE
100'
100'
100'
10'
10'
EXISTING LEVEE
APPROX. LEVEE DIMENSIONS
10'
B
APPROX. 2:1
114'
APPROX. 2:1
TYPICAL RIPRAP LENGTH
APPROX. ELEV. -13'
60" LAUNCHABLE RIPRAP TOE
WATERSIDE
6'
60.5'
LEVEE "B"
SCALE: 1"=40'
APPROX. ELEV. 17'
PEAK MODELED WSEL (1997 EVENT) 14.9'
3
1
30"
100'
100'
100'
30"
3
1
ELEV. 3.5'
ELEV. 0'
10'
FILTER
1
3
1
3
FILTER
60"
GRASS AND TULE PLANTINGS
B
LEVEE BREACH INLET CHANNEL ON MWT
SCALE: 1"=15'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


APPROX. LENGTH
3600'
LAUNCHABLE RIPRAP TOE
E
WATERSIDE
APPROX. 58'
APPROX. 2:1
5:1
10' ROADWAY
5:1
APPROX. 2:1
57'
60.5'
TYPICAL RIPRAP LENGTH
LANDSIDE
RIPRAP PROTECTION
LEVEE "E"
SCALE: 1"=40'
E
20'
EXISTING LEVEE
APPROX. ELEV. 15'
PEAK MODELED WSEL (1997 EVENT) 14.9'
12'
1'
ELEV. 5.5'
30"
APPROX. MTL 1.5'
ELEV. -2'
(VARIES)
6'
3'
RIPRAP PROTECTION
FILTER
60"
RIVER CHANNEL
CONCRETE CUT-OFF WALL
PAVED ROAD
1
2
2'
10'
E
DEGRADED SOUTHWEST LEVEE ON MWT
SCALE: 1"=10'
Source: Northwest Hydraulic Consultants 2005.
NOTE: ALL ELEVATIONS ARE NGVD


15'
4'x8' REINFORCED CONCRETE BOX CULVERT
31'
3.5'x4' TIDE GATES
24'
12"
8'
10'
22'
5'
PLAN VIEW
7'
21'
15.5'
APPROX. 2:1
EXISTING LEVEE
APPROX. 2:1
6'
CONCRETE CUTOFF WALL
4'
24"
6'
24"
FILTER
PROFILE VIEW
GATES
FILTER
12"
12"
3'
1'
3'
2'
ENTRANCE VIEW
EXIT VIEW
BOX CULVERT DESIGN
SCALE: 1"=10'
NOTE: ALL ELEVATIONS ARE NGVD
Source: Northwest Hydraulic Consultants 2005.


APPROX. LENGTH
3200'
NORTHERN SIDE
F
12'
TYPICAL RIPRAP LENGTH
22.5'
71'
16.5'
10'
10'
SOUTHERN SIDE
F
LEVEE "F"
SCALE: 1"=40'
PEAK MODELED WSEL (1997 EVENT) 14.8'
10'
ELEV. 5.5'
3
1
3
1
6'
ELEV. 0'
(VARIES)
10'
1
2
24"
6" FILTER
2'
2'
F
INTERNAL CROSS LEVEE ON MWT
SCALE: 1"=10'
NOTE: ALL ELEVATIONS ARE NGVD
Source: Northwest Hydraulic Consultants 2005.

Appendix C: Project Description

This project description is derived from the Project Description in the North Delta Flood Control and Ecosystem Restoration Project Draft EIR Project Description (Volume 1, Chapter 2) and a Project Management Plan (PMP) prepared jointly by the US Army Corps of Engineers and Reclamation District 2110. The PMP contains excerpted information from Chapter 2. A final and more detailed Operations and Maintenance Plan will be completed as part of the Feasibility Study for the McCormack-Williamson Tract under the USACE Project Management Plan.

Overall Program Goals and Objectives

Flood Control

To achieve flood control objectives, the primary strategy for Group I is degrading portions of the levee system to allow controlled flow across McCormack-Williamson Tract and marina outreach to address boat hazards during floods. Secondarily, downstream levee modifications may be necessary to mitigate hydraulic impacts, and channel dredging may be implemented to increase flood conveyance capacity.

Ecosystem Restoration

Floodplain forests and marshes would be recreated at McCormack-Williamson Tract. Natural hydrologic processes would be restored through one of three pilot program strategies to meet different ecological objectives:

- maximizing fluvial and tidal processes to create a diverse network of riverine, floodplain, and tidal habitats based on natural sedimentation and channel formation;
- maximizing floodplain habitat to benefit fish that spawn and rear on the floodplain by allowing flooding (with some tidal action to maintain water quality) during the wet season; or
- creating floodplain habitat as described above, combined with a demonstration project to reverse subsidence and increase elevations on the tract.

Landside levee slopes would be planted with trees, shrubs, and native grasses to improve habitat for wildlife. DWR has prepared a more complete description of the ecosystem restoration for McCormack-Williamson Tract as envisioned and articulated as a conceptual model for each of the three pilot program strategies. These conceptual models were developed with input from the science panel, resource agency representatives, and other stakeholders.

Recreation

Opportunities for recreation would be developed to be compatible with flood control and ecosystem restoration through the development of public access for fishing, wildlife viewing, and boat use. Recreation could be enhanced by:

- opening up the southern portion of McCormack-Williamson Tract to boating and/or
- improving Delta Meadows property.

Degrade McCormack-Williamson Tract East Levee to Function as a Weir

Objective

Extensive hydraulic modeling shows that it is necessary to degrade a portion of the east and southwest levees on McCormack-Williamson Tract to achieve desired flood control benefits in the upper portion of the Project area measured as stage reductions at Benson's Ferry. Because the North Delta study area is limited by channel capacity, and McCormack-Williamson Tract levees are legally restricted in height, water may overtop the east levee on McCormack-Williamson Tract during large storm events. When the east levee is overtopped, McCormack-Williamson Tract fills and causes the southwest levee to breach catastrophically, causing a surge effect downstream that displaces boats and precipitates further levee failures. Lowering the elevation of the McCormack-Williamson Tract levees would allow flow to move through the tract in a controlled manner, eliminating this surge effect. To convey high river stages into McCormack-Williamson Tract, the degraded east levee would be reinforced as a hardened weir to direct flow and minimize erosion.

Location

This Project component would affect the east levee of McCormack-Williamson Tract, about 1,000 feet west of I-5. The affected portion of the levee is approximately 3,700 feet long.

Design and Construction

The east levee of McCormack-Williamson Tract would be lowered to allow floodflows onto the tract. Three thousand feet of the east levee would be degraded to an elevation of .feet (from an existing elevation of 17.5 feet to 18 feet). This elevation has been established to maintain the current level of access to the transmission tower via the east levee, including a layer of rock slope protection (RSP) consisting of angular rock placed along the entire face and crest of the degraded levee as prescribed by the USACE (USACE). The levee crest would also include a paved access road with concrete retaining walls to serve as a pavement-containment edge and to prevent undercutting. The riverside levee slope would be over-excavated and RSP would be placed to protect against erosion caused by turbulence in the approaching flow.

On the landside levee toe, a three-foot deep sill would be excavated to dissipate energy from overtopping water cascading down the landside levee face. RSP would be placed from the levee crest down the landside face, in the toe sill, and onto the floor of the island for an additional six feet beyond the toe sill. RSP placed on the landside face of the levee and on the floor of the island would be placed directly on the existing land surface to avoid unnecessary excavation. One or more filter layers would be placed under all RSP areas to prevent scour of the underlying soil. Grading and excavation of exit channels would ensure that fish are not entrapped in the toe sill as floodwaters recede from the island.

Operations and Maintenance

Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Completely Degrade McCormack-Williamson Tract Southwest Levee to Match the Elevation of the Island Floor

Objective

The southwest levee of McCormack-Williamson Tract would be lowered to allow floodflows to pass out of the tract without causing a surge effect, as described above. To convey high river stages out of McCormack-Williamson Tract, the degraded southwest levee would either be reinforced as a hardened weir to direct flow and minimize erosion or completely degraded to match the elevation of the island floor. During low-flow seasons, the lowered southwest levee would allow tidal exchange on the island from the south.

Location

The southwest levee of McCormack-Williamson Tract is located on the southwest side of the island adjacent to Dead Horse Cut.

Design and Construction

The McCormack-Williamson Tract southwest levee would be degraded along the entire length of Dead Horse Cut to match the elevation of the island floor from the existing elevation. This would allow floodflows to pass out of the tract without causing a surge effect. This would also allow tidal water onto the tract from the southern end, facilitating the formation of dendritic intertidal channels at elevations near sea level and keeping the southernmost portion of the tract as shallow open water. The potential for scour along the embankment between the untouched levee and the breach requires the placement of angular along the grade-matching slope as well as the adjacent levee faces. A launchable RSP toe should be placed along the base of the grade and in the river channel along the levee toe. The area of protection required will vary with levee geometry, the invert of the Mokelumne River, and landform elevation within the tract. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil.

Operations and Maintenance

This feature will be adaptively managed to avoid inducing growth of nonnative invasive species. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Reinforce Dead Horse Island East Levee

Objective

Because of increased lateral flows and higher velocities from water flowing through McCormack-Williamson Tract, the riverside face of the eastern levee on Dead Horse Island may require additional erosion protection.

Location

This levee is located along the eastern edge of Dead Horse Island, directly across Dead Horse Cut from the southwestern end of McCormack-Williamson Tract.

Design and Construction

The entire Dead Horse Island east levee is currently protected with RSP. To withstand the increased lateral flows and velocities associated with water flowing through McCormack-Williamson Tract, the Dead Horse east levee would be reinforced with the placement of RSP. A launchable toe would be placed in the river channel to prevent scour of the waterside toe of the levee. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil.

Operations and Maintenance

Vegetation management (by herbicide application, mowing, or removal with hand tools) is currently required to maintain the Dead Horse levee. After reinforcement of the Dead Horse east levee, similar vegetation management may be required periodically.

Modify Downstream Levees to Accommodate Potentially Increased Flows

Objective

To address the hydraulic effects of opening McCormack-Williamson Tract to more frequent inundation and flow, downstream levees would be raised as needed on the North Fork Mokelumne River to maintain freeboard.

Location

Levees are proposed to be raised as needed along portions of the North Fork Mokelumne River. Levees on opposite sides of the waterway are proposed to be raised in parallel (i.e., matching in profile).

Design and Construction

Hydraulic modeling results indicate that the implementation of Alternative -A would require minor levee raises along portions of the North Fork Mokelumne River. These modest increases could be accomplished by adding stabilized and compacted aggregate base to the levee crown and would not affect the footprint or sideslopes of the levee.

Operations and Maintenance

The levees affected by this component would continue to be managed as they are under existing conditions. These activities include vegetation management (by herbicide application, mowing, or removal with hand tools), placement of RSP to address waterside erosion, and restoration of the aggregate base patrol road with new material placed and graded to maintain a drivable surface.

Construct Transmission Tower Protective Levee and Access Road

Objective

Construction of a protective levee would be needed to maintain the current level of flood protection for the property being leased by KCRA. All alternatives are required to maintain the current level of flood protection and road access with no additional flood risk for the property being leased. The levee would protect the transmission tower and associated control building. Degrading the McCormack-Williamson east levee would necessitate constructing a new access road to the transmission tower.

Location

The transmission tower protective levee would be constructed in the northwest corner of McCormack-Williamson Tract. The access road would be constructed along the degraded portion of the east levee on McCormack-Williamson Tract.

Design and Construction

The length of the levee would be 4,000 feet. The elevation of the levee is to be set to maintain the current level of protection and would key into the existing north and south levees. Borrow, which could come from the Grizzly Slough property and the Dixon and New Hope borrow sites (still to be determined), would provide the extra soils needed to build this levee. The access road would be integrated with the hardened weir structure constructed on the degraded portion of the east levee. The road surface would provide all-weather access, proposed to be concrete at the weir and compacted aggregate base on the levee crown.

Operations and Maintenance

The levee would be maintained according to current levee standards for vegetation control, erosion protection, slope stability, and patrol access, in a similar condition to existing levees. The access road would be managed for vegetation, either by mowing or herbicide application at the shoulders and sideslopes. The aggregate base surface would be periodically refreshed with new material and graded to maintain a drivable surface. In the event that the transmission tower lease was not continued, maintenance may be terminated or the levee may be removed.

Demolish Farm Residence and Infrastructure

Objective

A multi-family farmworker residence (the two-story, wood-frame type commonly used for housing migrant farmworkers) and associated farm outbuildings (sheds) would be removed to allow water to flow unimpeded through the tract, to prevent the structures from being dislodged during high flows, and to complement restoration of the tract to habitat.

Location

The structures are located in two concentrations on the southeast levee in the upper half of McCormack-Williamson Tract

Design and Construction

The structures would be demolished with bulldozers, and the material would be hauled away by dump trucks to an appropriate permitted disposal site. Select material, such as doors, windows, siding, lumber, timbers, and steel, may be salvaged. It should be noted that fuel tanks are present and it is likely that agricultural chemicals have also been stored on site; therefore, these locations would need to be evaluated for the potential to contribute hazardous materials into the aquatic environment from inundation. These fuel tanks would be removed, and any legacy contamination would be safely removed before flooding is allowed to occur.

Operations and Maintenance

No operations or maintenance would be required for this component.

Modify Landform and Restore Agricultural Land to Habitat

Objective

The cultivation of agricultural crops on McCormack-Williamson Tract would be discontinued, and the land would be restored to native vegetation types for wildlife habitat. Restoration activities would include modifying the landform to ensure positive drainage and minimize the potential for fish-stranding.

Location

The interior of McCormack-Williamson Tract would be affected by this action, except for levee slopes and the area included by the transmission tower protective levee .

Design and Construction

Under the fluvial process optimization scenario, hydrologic and hydraulic forces as allowed by degrading and breaching the levees are envisioned to reform the interior of McCormack-Williamson Tract and facilitate conditions for natural revegetation. To assist these processes and facilitate habitat benefit, minor grading would occur to ensure positive drainage and provide more diverse geomorphic surfaces. At the upper end of the tract on the landside of the east levee, large depressions resulting from scour caused by previous levee failure events would be filled with material from the degraded east levee to reduce the risk of fish-stranding when high flows recede. Smaller depressions along the west side of the tract would be treated similarly.

At the lower end of the tract, starter channels would be graded at intertidal elevations to encourage formation of natural dendritic tidal channels and to ensure positive drainage to minimize the potential for fish-stranding. It is intended that a dendritic channel network would provide a maximum amount of edge habitat for native fish as well as provide positive draining of the tract after high-flow events to avoid fish-stranding. The channels would be located within the intertidal zone, which would be inundated at mean high high water (MHHW) levels but dry at mean low low water (MLLW) levels. The channels therefore would dry out on a daily basis, preventing the establishment of exotic submerged aquatic vegetation. The channel system would be designed to mimic natural dendritic systems, in which surface drainage streams branch randomly at various angles. Excess material would be used to fill depressions described above.

To facilitate conversion to native vegetative cover types, a combination of passive and active approaches likely would be used. It is acknowledged that risk inevitably is associated with natural revegetation. Many factors contribute to this risk, such as proliferation of weed species in Central Valley wetland systems that are adapted to more aggressive colonization than native species, an altered hydrologic regime that is unpredictable relative to native seed dispersal, and uncertainty of the actual hydrologic and hydraulic patterns caused by the Project. These and other details will be evaluated during engineering design with the goal of ensuring establishment of desirable native vegetation; however, it should be noted that sites in the Project watershed are successfully recolonizing with native species, such as those at the upstream Cosumnes River Preserve.

To reduce risk and minimize potential for colonization by exotic vegetation species, native and non-invasive starter vegetation would be planted, such as tule in the wetter southern portion of the island and grasses in the drier northern part. Over time, flooding events would import propagules such as willows, cottonwoods, and perennial herbs that would naturally colonize on higher areas and tules and other water plants at intertidal and subtidal elevations. Planting of other woody and herbaceous species may be proposed in the final Project design, if further study shows they are warranted to ensure native vegetative cover and preclude nonnative invasive species. A supplemental irrigation system may also be implemented to facilitate vegetation establishment. These active approaches to revegetation would likely focus on compensatory habitat required for mitigation of Project impacts.

Operations and Maintenance

The overall approach to land management would be relatively “hands off,” similar to practices at TNC’s upstream Cosumnes River Preserve. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically. Prescribed burning and strategic grazing will be evaluated as elements of the Project’s adaptive management plan. Herbivore protection shelters and fencing may also be needed to prevent plant predation from beavers, although beavers may provide a benefit by thinning forested areas to maintain diverse cover. These actions will be elements of the Project’s adaptive management plan. Irrigation, if needed, would use existing agricultural siphons with a pressurized closed delivery system (i.e., pipes and nozzles).

Breach Mokelumne River Levee

Objective

The Mokelumne River levee of McCormack-Williamson Tract would be breached to allow a secondary channel of the Mokelumne River to meander through the tract and establish hydraulic connectivity between the breach and the southwestern end of McCormack-Williamson Tract. A starter channel would be excavated to facilitate channel-forming processes in the interior of the tract. Riparian forest should colonize the channel banks.

Location

The -foot breach would be cut into the southern levee on McCormack-Williamson Tract at approximately Station + on the Mokelumne River.

Design and Construction

The breach would be broken down into two side tiers at elevation 3.5 feet and one central tier at 0 feet (NGVD). The lower tier would remain unprotected so that it could scour and eventually form into a natural channel inlet. The side tiers would be planted to protect against erosion and to precipitate colonization of the area by appropriate species. To protect the interface between the breach and the existing levee RSP) would be placed along the exposed 3:1 slope that matches the different grades. A launchable RSP toe would be placed in the river channel to prevent undercutting of the RSP. One or more filter layers would be placed under all RSP to prevent scour of the underlying soil. A starter channel also would be excavated on the floor of the tract for approximately 3,000 feet to encourage flow through the inlet. The starter channel would be graded to integrate with the topography on the floor of the tract to minimize potential for fish-stranding and would drain toward the bottom of the tract.

Operations and Maintenance

This feature will be adaptively managed to avoid inducing growth of nonnative invasive species. Vegetation management (by herbicide application, mowing, or removal with hand tools) may be required periodically.

Appendix D: Project Management Plan

January 2011

CALFED LEVEE STABILITY PROGRAM

MCCORMACK-WILLIAMSON TRACT, CALIFORNIA FEASIBILITY STUDY

PROJECT MANAGEMENT PLAN

US Army Corps of Engineers ®

RD 2110

CONCURRENCE PAGE

Sacramento District,
U.S. Army Corps of Engineers

We, the undersigned, concur with the Project Management Plan for the McCormack-Williamson Tract Feasibility Study, California. We understand that this is a **"living"** management document that will be updated as needed throughout the process stated within.

NAME	TITLE	SIGNATURE	DATE
Kristina Mullins	Deputy DE for PPMD	_____	_____
Alicia Kirchner	Ch, Planning Division	_____	_____
Rick Poeppelman	Ch, Engineering Division	_____	_____
Sharon Caine	Ch, Real Estate Division	_____	_____
Alfred Faustino	Ch, Office of Counsel	_____	_____
Sue Yarborough	Ch, Contracting Division	_____	_____

CONCURRENCE PAGE

Non-Federal Sponsor

We, the undersigned, concur with the Project Management Plan for the McCormack-Williamson Tract Feasibility Study, California. We understand that this is a **"living"** management document that will be updated as needed throughout the process stated within.

NAME	TITLE	SIGNATURE	DATE
Brent Tadman	President and Trustee, Reclamation District 2110	_____	_____
Armand Fonseca	Trustee	_____	_____
Mike Conner	Trustee	_____	_____

FORWARD

Document Purpose

In recognition of the socio-economic and environmental importance of the Sacramento-San Joaquin Delta and the serious threat of levee failures with disastrous and widespread consequences, Congress passed the Water Supply, Reliability and Environmental Improvement Act, Public Law 108-361 ("CALFED Bay-Delta Authorization Act of 2004"). This Act provided for Corps participation in the CALFED Program by authorizing the Secretary of the Army to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality objectives. In May 2006, the Corps submitted the "CALFED Levee Stability Program Report to Congress" to implement a short-term strategy to quickly address flood risk from levee instability. The CALFED Levee Stability Program prioritized a list of proposed projects in the Delta.

For the McCormack-Williamson Tract Feasibility Study (MWTFS), this Project Management Plan (PMP) describes the pertinent management and planning methods, defines the activities to be accomplished, and establishes the schedule and budget necessary for successful completion of the Project Implementation Report (PIR). PIRs present the results of investigations of a project and include the cost effective recommendations for approval by the Commander of the South Pacific Division. The PMP reflects an agreement between the non-Federal sponsor and the Sacramento District regarding the procedures, scope, schedule, and budget associated with the planning process to develop a PIR and accompanying National Environmental Policy Act and California Environmental Quality Act (NEPA/CEQA) documentation.

In summary, the primary purposes of this PMP are to communicate the following about the study:

- briefly describe the background of the program, project and study area,
- explain relevant management strategies for project development,
- outline an appropriate planning methodology for the report,
- establish the scope, budget, and schedule associated with successful completion.

Project Purpose

In the case of the MWTFS, the primary purposes are flood risk management and ecosystem restoration.

CONTENTS

TABLES

APPENDICES

ACRONYMS

AAR	After Action Review
A-E	Architectural and Engineering
AFB	Alternative Formulation Briefing
ATR	Agency Technical Review
ATRT	Agency Technical Review Team
BCR	Benefit Cost Ratio
BDCP	Bay-Delta Conservation Program
CADD	Computer Aided Design and Drafting
CAFM	Computer Aided Facility Management
CAR	Coordination Act Report
CE	Cost Effectiveness
CEFMS	Corps of Engineers Financial Management System
CEQA	California Environmental Quality Act
CESPD	Corps of Engineers, South Pacific Division
CESPK	Corps of Engineers, Sacramento District
DFG	California Department of Fish and Game
DILFS	Delta Islands and Levees Feasibility Study
DM	Design Memorandum
DRMS	Delta Risk Management Strategy
DST	District Support Team
DWR	California Department of Water Resources
DQC	District Quality Control
EA	Environmental Assessment
EC	Engineer Circular
eGDS	Enterprise Geospatial Data System
EI	Engineering Instructions
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
ESA	Endangered Species Act
ETM	Engineering Technical Managers
FCSA	Feasibility Cost-Sharing Agreement
FESSRO	FloodSAFE Environmental Stewardship & Statewide Resources
FGDC	Federal Geographic Data Committee
FONSI	Finding of No Significant Impact
FRM	Flood Risk Management
GDP	Geospatial Data Management Plan
GIS	Geographic Information Systems
H	Horizontal
H & H	Hydrology and Hydraulics
HEP	Habitat Evaluation Procedures
HQUSACE	Headquarters, U.S. Army Corps of Engineers
HTRW	Hazardous, Toxic, and Radioactive Waste
IEPR	Independent External Peer Review
IS	Initial Study

LERRDS	Lands, Easements, Right-of-ways, Relocations, and Disposal Sites
LSP	Levee Stability Program
M-CACES	Micro-Computer Aided Cost Estimate System
MSC	Major Subordinate Command
MWTFS	McCormack-Williamson Tract Feasibility Study
NAD	North American Datum
NAHC	Native American Heritage Commission
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NGVD 29	National Geodetic Vertical Datum 1929
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
PCoP	Planning of Community of Practice
PCX	Planning Center of Expertise
PDPIR	Preliminary Draft Project Implementation Report
PDT	Project Delivery Team
PED	Pre-construction Engineering and Design
PEIR	Programmatic Environmental Impact Report
PEIS	Programmatic Environmental Impact Study
PES	Project Executive Summary
PGM	Project Guidance Memorandum
PgMP	Program Management Plan for the CALFED Levee Stability Program
PIR	Project Implementation Report
PL	Public Law
PMBP	Project Management Business Process
PMP	Project Management Plan
PPA	Project Partnership Agreement
PRB	Project Review Board
QA/QC	Quality Assurance/Quality Control
QCP	Quality Control Plan
QMP	Quality Management Plan
RD 2110	Reclamation District 2110
ROD	Record of Decision
RTS	Regional Technical Specialists
SACCR	Schedule and Cost Change Request
SDSFIE	Spatial Data Standard for Facilities, Infrastructure and Environment
SHPO	State Historic Preservation Officer
SOW	Scope of Work
UFC	Unified Facilities Criteria
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
V	Vertical
VE	Value Engineering
VM	Value Management
WRDA	Water Resources Development Act

CHAPTER 1. **INTRODUCTION**

PURPOSE AND SCOPE OF THE PMP

The CALFED Levee Stability Program (LSP) provides for a short-term strategy to address flood control, water quality, water supply, and ecosystem restoration projects within the Sacramento River and San Joaquin River Delta (Delta). While the majority of proposed projects focus primarily on flood risk management elements, there is an opportunity for other projects to be considered and constructed that combine flood risk management with other CALFED LSP authorized purposes of ecosystem restoration, water quality, water conveyance, or water supply as the sole project purpose. Under the CALFED LSP, 54 project proposals have been prioritized for review in the Report to Congress, USACE [U.S. Army Corps of Engineers] Strategy for Action (May 2006), and the McCormack-Williamson Tract project has been identified as one of the projects to be undertaken as part of the CALFED LSP. Additional background information regarding the CALFED LSP can be found in Chapter 2 Study Background**.**

The purpose of this Project Management Plan (PMP) is to outline identified study tasks, products, schedule, and cost estimates associated with conducting a cost-shared feasibility study through preparation of a final project implementation report (PIR). The McCormack-Williamson Tract Feasibility Study (MWTFS) PMP defines a contract between the Corps of Engineers (Corps), Sacramento District (CESPK) and the non-Federal sponsor (Reclamation District 2110 [RD 2110]) for potential collaborative actions concerning the McCormack-Williamson Tract levee stability project in Sacramento County, California.

The PMP is a basis for management of the MWTFS. The non-Federal sponsor and CESPK may further refine the technical Scopes of Work (SOWs) for this study. Once these SOWs are written, this PMP will be revised to reflect the work that will be done by and at the direction of CESPK and by the sponsor to receive work-in-kind credit. The scope and level of detail of this PMP will likely change over the duration of the study as more information and/or resources become available. The PMP will be used as the principle tool for managing the feasibility study. Each study team member, including the non-Federal sponsor, will receive a copy of this document and any updates.

The PMP is a basis for the review and evaluation of the PIR. Since the PMP represents a contract among study participants, it will be used as the basis to determine if the draft PIR has been developed in accordance with established procedures and previous agreements. The PMP reflects mutual agreements of the district, division, and sponsor on the scope, critical assumptions, methodologies, and level of detail for the studies that are to be conducted during the feasibility study. Review of the draft PIR will be performed to ensure that the study has been developed and coordinated to be consistent with these agreements. The objective is to achieve early concurrence that the project is developed in a way that can be supported and approved by the Corps South Pacific Division (CESPD).

The PMP is a study management tool. It includes SOWs that are used for fund allocation by the project manager. It forms the basis for identifying commitments to the non-Federal sponsor and serves as a basis for performance measurement.

KEY ASSUMPTIONS AND CAVEATS

It is recognized that this initial PMP for the MWTFS is considered to be a living document, which is subject to change and revision in the future as needed. Presently, key assumptions are:

- The Corps is authorized to spend up to $100,000 to initiate the study, which includes preparing the PMP, initiating the PIR, and negotiating the Feasibility Cost Sharing Agreement (FCSA). This $100,000 is the sole responsibility of the Corps and is not included in the costs to complete the MWTFS, consistent with the Corps Headquarters Implementation Guidance for the Water Resources Development Act of 2007 – Section 3015 (WRDA 2007) provided for projects under the CALFED Levee Stability Program;
- Current total estimated cost for the MWTFS is expected to be $2,914,000 of which $1,257,000 is the sponsor's cost and $1,657,000 is the federal cost;
- The federal cost reflects the 100 percent responsibility of the Corps for the $300,000 for an Independent External Peer Review (IEPR) contract, consistent with the Corps Headquarters Implementation Guidance for the WRDA 2007 provided for projects under the CALFED Levee Stability Program and Corps' Civil Works review Policy;
- Up to $209,000 of the non-Federal requirement is expected to be in the form of in-kind credit for work performed after the execution of this agreement, subject to Corps audit.
- Other work performed/data collected that will benefit the study development, but was performed prior to the execution of a FCSA, is not creditable, but will reduce overall study costs and timeline.
- RD 2110 will work with the California Department of Water Resources (DWR), FloodSAFE Environmental Stewardship & Statewide Resources Office (FESSRO) to assist with funding the sponsor's cost of the MWTFS.

SUMMARY OF PROJECT MANAGEMENT PLAN CONTENTS:

This PMP is comprised of the following chapters:

- Chapter 1 – Purpose and Scope. This chapter includes the definition of the PMP for the MWTFS and a summary of the PMP requirements.
- Chapter 2 – Study Background. This chapter includes information concerning the study area (**Appendix A),** study authority, study purpose, and relevant plan formulation information for the MWTFS.
- Chapter 3 – Management of Feasibility Study. This chapter defines the study management structure including the Project Delivery Team (PDT) and Executive Committee. It also highlights the types and purposes of various study management documents.
- Chapter 4 – Feasibility Study Products. This chapter explains the types of implementation study products. It also provides an explanation of the unique authority for projects under the CALFED Levee Stability Program, and where applicable, a listing of the technical requirements.

- Chapter 5 – Study Cost Estimate and Tasks. This chapter provides a summary of study scopes, schedules, and budgets for major study tasks and a breakdown of those costs and responsibilities between Federal and non-Federal interests. It also includes a description of the major study tasks and subtasks that makeup the work to be accomplished, in narrative form, that answers the questions: "what, how, and how much."
- Chapter 6 – Study Milestones and Schedule. This chapter defines the key milestones or decision points for the feasibility study. It also includes an estimate of the schedule for accomplishing the study tasks and products (included as **Appendix B**).
- Chapter 7 - Quality Control Plan: This chapter supplements the District's Quality Control Plan. It highlights any deviations to the District's plan and lists the members of the study team and the Agency Technical Review team.

This page left intentionally blank

CHAPTER 2. STUDY BACKGROUND

CALFED LEVEE STABILITY PROGRAM

In recognition of the socio-economic and environmental importance of the Delta and the serious threat of levee failures with disastrous and wide-spread consequences, Congress passed the Water Supply, Reliability and Environmental Improvement Act, Public Law (PL) 108-361 ("CALFED Bay-Delta Authorization Act of 2004"). This Act provided for Corps participation in the CALFED Program by authorizing the Secretary of the Army to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality objectives. In May 2006, the Corps submitted the "CALFED Levee Stability Program Report to Congress", which satisfied the CALFED Bay-Delta Authorization Act requirement to submit a report to Congress that describes the levee stability reconstruction projects and priorities that were to be carried out under the program within the Delta. This report was prepared with non-Federal input and support and identified 54 projects totaling more than $1 billion in estimated costs. One of the submissions to the USACE for consideration under this program was the proposed McCormack-Williamson Tract project.

AUTHORIZATION AND POLICY FRAMEWORK

Authorization for the CALFED Levee Stability Program is contained in Section 103(f)(3) of the Water Supply, Reliability, and Environmental Improvement Act (Public Law 108-361). This authorization was subsequently amended by Section 3015 of the Water Resources Development Act of 2007 (Public Law 110-114) and Section 210 of the FY 2010 Energy and Water Appropriations Act (Public Law 111-85).

CALFED Bay-Delta Authorization Act of 2004

The original authorization for the CALFED Levee Stability Program is found in Title I of the Water Supply, Reliability, and Environmental Improvement Act, which is the CALFED Bay-Delta Authorization Act. Specifically the authorization is located in Section 103 which is titled "Bay Delta Program", subsection (f), which is titled "Description Of Activities Under New and Expanded Authorizations," and subsection (3) titled "Levee Stability." This section states:

> *"(A) IN GENERAL. - For purposes of implementing the CALFED Bay-Delta Program within the Delta (as defined in Cal. Water Code section 12220), the Secretary of the Army is authorized to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance, and water quality objectives.*
>
> *(B) REPORT. - Not later than 180 days after the date of enactment of this Act, the Secretary of the Army shall submit to the appropriate authorizing and appropriating committees of the Senate and the House of Representatives a report that describes the levee stability reconstruction projects and priorities that will be carried out under this title during each of fiscal years 2005 through 2010.*

(C) SMALL FLOOD CONTROL PROJECTS. - Notwithstanding the project purpose, the authority granted under section 205[1] *of the Flood Control Act of 1948 (33 U.S.C. 701s) shall apply to each project authorized under this paragraph.*

(D) PROJECTS.[2] *- Of the amounts authorized to be appropriated under section 109,*[3] *not more than $90,000,000 may be expended to –*

(i) reconstruct Delta levees to a base level of protection (also known as the "Public Law 84-99 standard");

(ii) enhance the stability of levees that have particular importance in the system through the Delta Levee Special Improvement Projects Program;

(iii) develop best management practices to control and reverse land subsidence on Delta islands;

(iv) develop a Delta Levee Emergency Management and Response Plan that will enhance the ability of Federal, State, and local agencies to rapidly respond to levee emergencies;

(v) develop a Delta Risk Management Strategy after assessing the consequences of Delta levee failure from floods, seepage, subsidence, and earthquakes;

(vi) reconstruct Delta levees using to the maximum extent practicable, dredged materials from the Sacramento River, the San Joaquin River, and the San Francisco Bay in reconstructing Delta levees;

(vii) coordinate Delta levee projects with flood management, ecosystem restoration, and levee protection projects of the lower San Joaquin River and lower Mokelumne River floodway improvements and other projects under the Sacramento-San Joaquin Comprehensive Study; and

(viii) evaluate and, if appropriate, rehabilitate the Suisun Marsh levees."

Water Resources Development Act of 2007

Section 3015 of the Water Resources Development Act of 2007 (WRDA 2007; PL 110-114) amended the original authorization as follows:

"SEC. 3015. CALFED STABILITY PROGRAM, CALIFORNIA.

(a) Amendments.--Section 103(f)(3) of the Water Supply, Reliability, and Environmental Improvement Act (118 Stat. 1695-1696) is amended--

[1] Section 205 is a legislative authority under which the Secretary of the Army, acting through the Chief of Engineers, is authorized to plan, design, and construct certain types of water resources projects without additional and specific congressional authorization. Under this authority, projects are formulated for flood damage reduction primarily, but incidental water resources purposes may be included. Each project is limited to $7 million Federal funding.

[2] This report will refer to these as authorized activities to avoid confusion with the common usage of the term "project" by USACE.

[3] Section 109: "Authorization of Appropriation. There are authorized to be appropriated to the Secretary and the heads of the Federal agencies to pay the Federal share of the cost of carrying out the new and expanded authorities described in subsections (e) and (f) of section 103 $389,000,000 for the period of fiscal years 2005 through 2010, to remain available until expended."

(1) in subparagraph (A) by striking ``within the Delta (as defined in Cal. Water Code Sec. 12220)'';

(2) by striking subparagraph (C) and inserting the following:

``(C) Justification.--

``(i) In general.--Notwithstanding section 209 of the Flood Control Act of 1970 (42 U.S.C. 1962-2), in carrying out levee stability programs and projects pursuant to this paragraph, the Secretary of the Army may determine that the programs and projects are justified by the benefits of the project purposes described in subparagraph (A), and the programs and projects shall require no additional economic justification if the Secretary of the Army further determines that the programs and projects are cost effective.

``(ii) Applicability.--Clause (i) shall not apply to any separable element intended to produce benefits that are predominantly unrelated to the project purposes described in subparagraph (A).''; and

(3) in subparagraph (D)(i) by inserting ``as described in the Record of Decision'' after ``Public Law 84-99 standard)''.

(b) Additional Authorization of Appropriations.--In addition to funds made available pursuant to the Water Supply, Reliability, and Environmental Improvement Act (Public Law 108-361) to carry out section 103(f)(3)(D) of that Act (118 Stat. 1696), there is authorized to be appropriated to carry out projects described in that section $106,000,000, to remain available until expended."

These amendments had several significant implications for program activities. First, Section 3015 (a)(1) removed a State of California's geographic definition of the Delta. In conjunction with Section 3015 (a)(3) which added a statement referring to the CALFED Bay-Delta Program, Programmatic Record of Decision, this significantly broadened the areas where projects could be implemented, extending potential project areas to watersheds which may affect the Delta. Second, Section 3015 (a)(2) removed any requirement of the projects implemented under this authority to meet any of the conditions of Section 205 of the Flood Control Act of 1948 (33 U.S.C. 701s), effectively removing an $11 million limit on project construction costs.

Third, the WRDA 2007 replaced Section 103(f)(3)(C) with a new section on "Justification" which states that "the Secretary of the Army may determine that the programs and projects are justified by the benefits of the project purposes described in subparagraph (A), and the programs and projects shall require no additional economic justification if the Secretary of the Army further determines that the programs and projects are cost effective." The amended Section 103(f)(3)(C) also specifies that the Secretary's determination noted above "shall not apply to any separable element intended to produce benefits that are predominantly unrelated to the project purposes described" in Section 103(f)(A) of PL 108-361. Last, section 3015 (b) increased the total program authorization to $196 million in Federal funds.

Energy and Water Development Appropriations Act of 2010

Section 210 of the Fiscal Year 2010 Energy and Water Appropriations Act, Public Law 111-85, amended the original authorization as follows:

> "Section 210. Title I of Public Law 108-361 is amended by striking '2010' wherever it appears and inserting '2014' in lieu thereof."

This amendment extended the authorization for projects to be implemented under Section 103(f)(3) of Public Law 108-361 through Fiscal Year 2014.

Program Guidance Memorandum

The U.S. Army Corps of Engineers Headquarters (HQUSACE) issued a memorandum entitled Implementation Guidance for the Water Resources *Development Act of 2007 (WRDA 2007) – Section 3015 CALFED Levee Stability* on 11 August 2008 (Appendix A). The memorandum provided policy guidance for implementation of the program in response to the significant changes in program authority embodied in WRDA 2007, focused principally on providing guidance for levee improvement projects. The guidance:

- emphasized that the primary purpose of the levee stability projects implemented under the CALFED Levee Stability Program are flood risk management with incidental outputs from ecosystem restoration, water supply, water conveyance, and water quality objectives;
- outlined a process to implement projects in two phases (a "feasibility phase" and a "design and implementation phase");
- described cost sharing and other responsibilities of non-Federal sponsors;
- articulated a streamlined process and delegated authority for decision document approval to the South Pacific Division Commander in recognition of the need for expedited action; and
- encouraged consideration of beneficial use of dredged material from the Sacramento River, San Joaquin River, and San Francisco Bay for any levee stability projects carried out under this authority.

The memorandum further states that other authorized activities, such as development of best management practices, development of a Delta Levee Emergency Management and Response Plan, and a Delta Risk Management Strategy, are intended to be carried out in a similar fashion to the Planning Assistance to States Program and cost shared at 50 percent Federal, 50 percent non-Federal expense. As a matter of policy, the memorandum expanded the list of activities with which the CALFED Levee Stability Program should coordinate, to include significant related State of California initiatives that were not specifically mentioned in PL 108-361, Section 103 (f)(3).

OTHER RELATED PROGRAMS

The Delta is one of California's and the United States' most important natural resources. The extensive levee system in the Delta maintains numerous valued resources, including water supply, water quality, flood protection, and habitats for numerous species. Because levees in the Delta are so important to local, State, and Federal interests, other important programs have started to address levee stability issues that are complementary to and coordinated with the CALFED Levee Stability Program (LSP). These programs, and their relation to the CALFED Levee Stability Program, are briefly described below.

Delta Islands and Levees Feasibility Study

The Delta Islands and Levees Feasibility Study was initiated in 2006, with the DWR as the non-Federal sponsor, to investigate flood risk management, ecosystem restoration, water supply, water quality, and recreation. Whereas the CALFED LSP is generally considered to provide short-term actions (three to five years to complete construction) within the Delta, this study effort is considering a longer-term approach (five to 20 years to complete construction) to levee stability improvement measures that would improve resistance to flood events, and decrease erosion and seepage potential at islands determined critical to water quality, water supply, and protection of significant public infrastructure. The study is also considering setback levees, floodplain reconnection, and restoration of wetlands and riparian habitats in the Delta.

Delta Risk Management Strategy (DRMS)

The 2000 CALFED Record of Decision presented a Preferred Program Alternative that described actions, studies, and conditional decisions to help fix major problems in the Delta. Included in the Preferred Program Alternative was the completion of a DRMS that would look at sustainability of the Delta, and that would assess major risks to Delta resources from floods, seepage, subsidence, and earthquakes. DRMS also evaluates the consequences, and identifies recommendations to manage the identified risks. Phase 1 of DRMS was completed and the results published in February 2009. Phase 2 of DRMS is expected to provide different measures and alternatives to the risks presented in the Phase 1 report. These measures and alternatives would manage levee failure risks in the Delta and improve the management of state funding that supports future levee maintenance and improvement.

Bay-Delta Conservation Program (BDCP)

The BDCP is a collaborative effort by state and federal agencies and stakeholder groups to develop a conservation plan for the Delta aimed at addressing the current conflict between the protection of at-risk fish species and water supply. The BDCP will likely consist of several major elements, including new capital improvements to the water supply conveyance system, a restoration program for important habitats within and adjacent to the Delta in order to improve the ecological productivity and sustainability of the Delta, and monitoring and adaptive management for the restoration program. The plan will also likely include operational improvements for the water supply system in the near-term and for the long-term once any capital improvements have been completed and are operational.

GEOGRAPHIC AREA

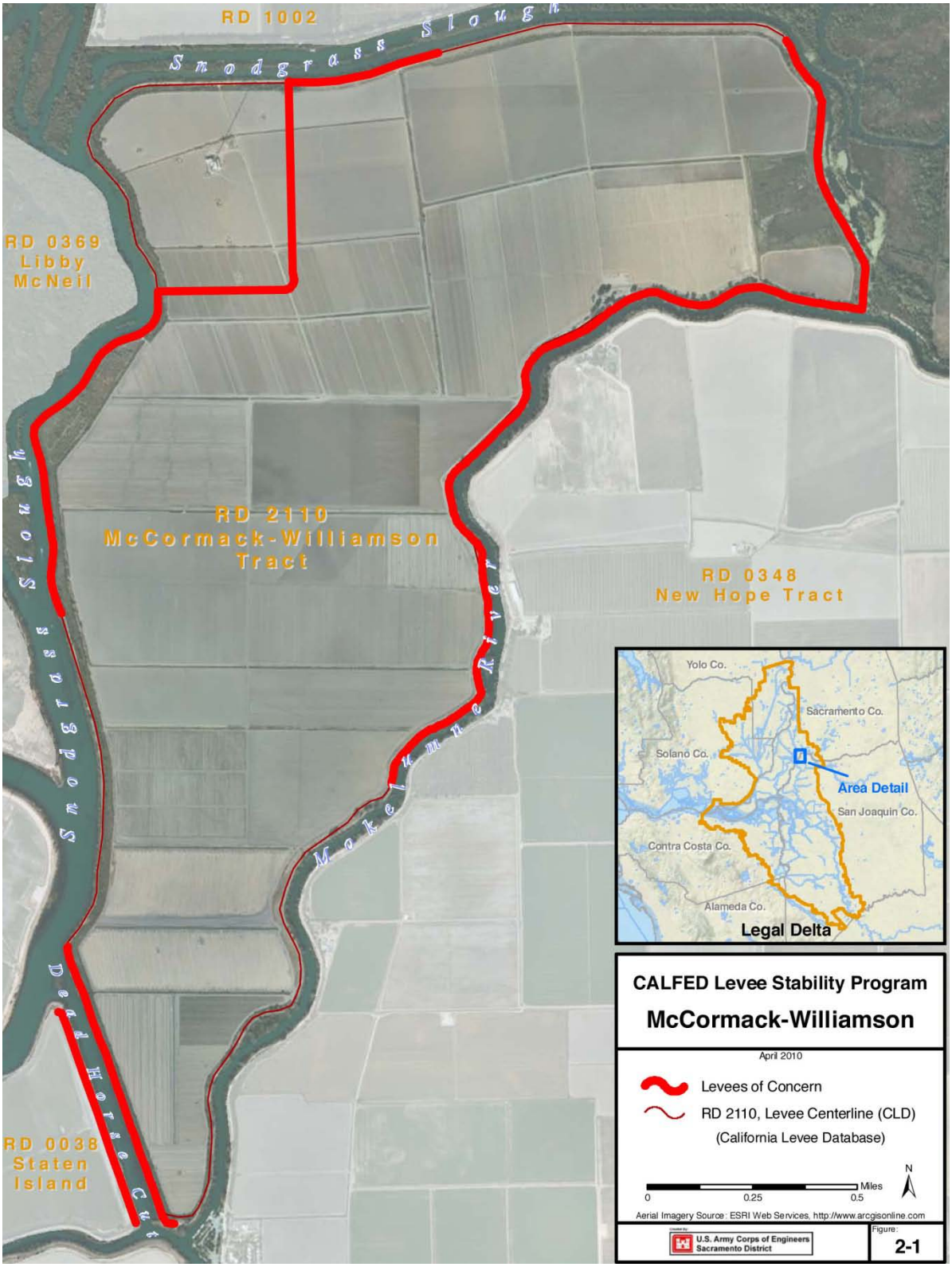
Sacramento-San Joaquin River Delta

The Sacramento-San Joaquin Delta is largely a rural area in a complex maze of tributaries, sloughs, and islands; a transportation network (roads, railroads, and navigation channels); and an altered remnant of the largest estuary on the West Coast. It is a haven for plants and wildlife, supporting more than 750 plant and animal species. The Delta consists of about 738,000 acres in six counties, encompassing some 80 tracts and islands with 1,100 miles of levees. Numerous rivers and sloughs intertwine through the Delta, and deliver freshwater to the San Francisco Bay and to water supply pumps in the south Delta. As the hub of California's two largest water conveyance systems – the Bureau of Reclamation's Central Valley Project and the California's State Water Project – the Delta is critical to the national economy because it supplies drinking water to more than 25 million Californians and irrigation water for more than 7 million acres of some of the most highly productive agricultural land in the world. The Delta also supports a population of more than 500,000 in the cities of Antioch, Brentwood, Isleton, Pittsburg, and Tracy, and in other cities adjoining the Delta such as Sacramento, Stockton, and West Sacramento.

McCormack-Williamson Tract

McCormack-Williamson Tract is in the North Delta east of the Sacramento River in an area defined as the "Primary Zone" by the Delta Protection Act of 1992 (California Public Resources Code 297000 et seq.). Located in Sacramento County, the Tract is bordered by Lost Slough to the north and northeast, the South Fork of the Mokelumne River to the east, Dead Horse Cut to the southwest, and Snodgrass Slough to the west (see **Figure 2-1 – Location Map**). The tract is approximately 1,654 acres and is protected by 8.8 miles of non-project levees. The interior of the island is primarily used for agriculture, although a television transmission tower is located in the northwestern portion of the tract. Most of the site is composed primarily of silt loam and clay, with sandy loam located in the northeastern portion of the site. Interior elevations generally range from approximately -5 to 5 feet (NGVD 29), with a few exceptions. Surrounding tracts and islands include: Pierson District and Glanville Tract to the north, Libby McNeil, Walnut Grove, and Dead Horse Island to the west, Staten Island to the south and New Hope Tract to the east. As flooding of the McCormack-Williamson Tract can increase flood risks at Walnut Grove, Dead Horse Island, and Staten Island, those tracts are also included in the Study Area. The McCormack-Williamson Tract was purchased by The Nature Conservancy (TNC) for the goal of ecosystem restoration and the protection of wildlife in the study area. With the cooperation of TNC and RD 2110, DWR prepared the North Delta Flood Control and Ecosystem Restoration Project Draft EIR in 2007 to specifically address flood risk and ecosystem restoration in the study area. A Final EIR for this project was completed and certified by DWR in December 2010.

Figure 2-1 Location Map



FOCUS OF THE FEASIBILITY STUDY

Problems and Opportunities

The McCormack-Williamson Tract levees are constrained in height by a legal agreement and as a result the tract has flooding during high water events, particularly along the eastern boundary, due to a phenomenon known as a flood surge effect. The inflow of water during these events can create scour holes, result in damage to the levees, and if sufficient water accumulates, generate a downstream flood surge when other portions of the levees (typically along the western and southern boundaries) are overtopped or fail. This flood surge poses a risk to lives, property, and infrastructure in adjacent areas, including Walnut Grove, Dead Horse Island, Staten Island and the marina at New Hope Landing. During flood events, unmoored boats can become lodged against the New Hope Bridge, compounding channel constriction. The channel constriction can cause water surface elevations to rise and back up water flow, which could create unstable conditions in adjacent areas. This can result in substantial property damage and threaten human safety, both in the immediate area and on adjacent islands. Uncontrolled flooding at McCormack-Williamson Tract could pose a threat to public facilities and infrastructure in the North Delta area, including Interstate 5, the Union Pacific Railroad line, and the Rio Cosumnes Correctional Center.

In addition, portions of the levees surrounding the tract are unstable and require improvement to avoid failure that could result in flooding of the tract and/or damage to the adjacent properties. Levee stability issues include landside levee slopes that are over-steepened, with some slopes steeper than 1H:1V. The over-steepened slopes are the result of damage that occurred during a flood in 1997, when the island was inundated. Dense vegetation exists on a large portion of the perimeter levee system, both on the landside and waterside. In many areas, the vegetation is dense enough that the over-steepened conditions are not visible. The levees were originally constructed using material that is predominantly sand. The crown has very little aggregate base on the surface, making the levees difficult to navigate during wet conditions. The crown width generally varies between 15 and 20 feet. In many areas, vegetation restricts access, with enough width to accommodate only a single vehicle. The waterside slopes are largely unarmored. Broken concrete slabs and riprap have been placed in various areas.

The Delta currently supports an estimated 750 species of plant and animal species that are, in part, supported by Delta levees that maintain flows and water quality. Development of the Delta over the past 150 years, however, has resulted in a substantial reduction in wetlands, intertidal marsh, and shaded riverine aquatic (SRA) habitats, which in turn has resulted in the formal designation of numerous species as endangered or threatened. Typical measures used to repair or stabilize levees often lead to negative impacts to critical habitat for these Delta species. For example, rocking in-water levee slopes has been associated with loss of critical habitat for endangered species of fish (e.g., salmonids).

Previous work on McCormack-Williamson Tract has addressed some of the levee stability concerns, but longer term solutions are needed. Previous work included reshaping the levees from Stations 50+00 to Station 140+00 and from Station 355+00 to Station 425+00 to create habitat friendly levees by flattening the landside levee slope, creating a habitat bench, and planting vegetation (in three elevation-based “zones”) to provide protection against wind waves and high water levels when the Tract is flooded in the future. Work proposed in conjunction with the MWTFS would be consistent with this recently-completed work.

With this study effort, there is an opportunity to reduce the risk to life and property from occasional flooding or catastrophic breaching of the McCormack-Williamson Tract levee and to provide ecosystem restoration. One alternative for consideration is to lower the height of the eastern levees, which would increase flooding of the tract (and reduce upstream flood risks), reduce the height of the southwestern levee (which would reduce the potential for a flood surge when those levees are overtopped), increase the height of levees on adjacent islands (such as Staten Island, to reduce flood risk), and install a new levee to protect the transmission tower. This alternative would create tidal, intertidal, and shaded riverine habitat, providing ecosystem restoration benefits. This proposed McCormack-Williamson Tract project represents an opportunity to achieve multiple CALFED LSP purposes that complement one another and present a more balanced solution to levee stabilization along the McCormack-Williamson Tract.

Study Purpose

Flood risk management and ecosystem restoration are the study purposes for the MWTFS.

Planning Objectives

Planning objectives for the feasibility study include:

- reduce upstream flood stages on the Mokelumne River,
- reduce flood surges through the McCormack-Williamson Tract,
- reduce flood risk to adjacent areas, populations and infrastructure in the study area,
- reduce levee operations and maintenance costs,
- rehabilitate and upgrade unstable levee sections on Dead Horse Island, Staten Island, and Tyler Island, and
- increase fish and wildlife habitat and ecosystem value in the study area.

Planning Constraints

Planning constraints identified for the MWTFS include:

- Compliance with all applicable laws and regulations;
- The height of the levees, which are constrained by a legal agreement recorded July 26, 1947, in Book 1382, page 84 of the Official Records of Sacramento County, are less than the PL 84-99 Delta specific standard;
- Water quality regulations enforced by the Central Valley Regional Water Quality Control Board for dredging and other wet construction activities in the Delta;
- In-water work time window enforced by National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) limited from August 1 to September 30; and
- No adverse impacts on water quality (e.g., salinity) affecting water supplies.

Future Without Project Conditions

As the levees around the McCormack-Williamson Tract are constrained in height by legal agreement, the tract is subject to occasional uncontrolled flooding during high water events. These events result in damage to the levees and create the potential for a downstream flood surge. The existing condition of the levees also creates the potential for a catastrophic levee failure (e.g., a sunny day event). These conditions will worsen over time and ultimately, a section of levee will likely fail. Therefore, future without-project conditions resulting from a no action alternative can include, but are not limited to:

- The risk of increased vulnerability to flooding as natural processes - such as levee erosion, subsidence and sea level rise - continue to diminish the ability of existing structures to protect interior lands;
- Potential loss of lives and residences should a levee breach occur;
- Potential disruption of Delta water exports and local water supplies for agricultural, and municipal and industrial water uses should a levee breach occur;
- Potential disrupted use of local infrastructure such as roadways and various utilities in the study area (natural gas, electric and wastewater services);
- Potential loss of local revenue from recreational activities, such as: water skiing, jet skiing, golf, camping, wind surfing, sailing, motor boating, fishing, hunting, bird watching, swimming, shopping and dining;
- Potential ecological impacts from flooding to Threatened and Endangered species;
- Potential economic impact to lost agriculture production; and
- Potential additional damages in the event there is an increase in residential and commercial development on the island.

Summary of Initial Alternatives and their Risks and Benefits

The PDT has completed an initial assessment of management measures and formulated several initial alternatives. During this plan formulation process, the PDT discussed both structural and non-structural measures to address the flood risk problems associated with the levees at McCormack-Williamson Tract. While further refinement and/or development of additional alternatives may occur as part of the iterative plan formulation process, the current proposed alternatives for the MWTFS include:

1. No Action Alternative. This alternative would result in the continued uncontrolled flood surges, property damage, erosion and seepage of levees, and require regular repair work in the study area. This alternative would result in a higher risk of levee failure and flood damage in the future due to continued degradation of levees in the study area. There are no identifiable benefits to this alternative.

2. Alternative 2 (DWR Alternative 1-B). This alternative would consist of reducing the height of the eastern and southwestern levees, reslope approximately 18,000 feet of existing landside levee to create a habitat bench, enhancement of landside levee habitat, reinforcement of 3,800 feet of the Dead Horse Island east levee with riprap blanket on waterside slope, construction of protective levee on the landside of the transmission tower on the northwest corner of the tract, demolition of a farm residence and associated farm buildings, raise 40,000

feet of the Staten Island levee up to 3 inches along the southern stretch of the North Fork of the Mokelumne River, and modify the landform and restore agricultural land to habitat. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern degraded levee at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. The risks of this alternative are adverse environmental consequences, including the loss of sensitive habitats (e.g., elderberry bushes), potential for fish strandings, and effects on threatened and endangered species (e.g., from in-water construction work). The study will address ways to reduce the potential for fish stranding and loss of habitat for special-status species, especially those of the Valley elderberry longhorn beetle. The benefits of this alternative would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, and reduced Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) requirements.

3. Alternative 3 (DWR Alternative 1-C). This alternative would include all of the elements of Alternative 2 and the construction of a cross-levee on the lower third of the McCormack-Williamson Tract to promote sedimentation as part of a subsidence reversal demonstration project. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern degraded levee at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. This alternative would result in adverse environmental impacts generally similar to those identified in Alternative 1. The study will address ways to reduce the potential for fish stranding and loss of habitat for special-status species, especially that of the Valley elderberry longhorn beetle. Benefits would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, reversal of land subsidence, and reduced OMRR&R requirements.

4. Alternative 4 (DWR Alternative 1-A). This alternative would include all of the elements of Alternative 2, with the addition of breaching of the Mokelumne River levee in the northeast portion of the Tract, and the construction of an interior channel (from the location of the levee breach) and associated ecosystem restoration features to allow for tidal influences in the northern portion of the island and reduce fish strandings in the southern portion of the Tract. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern levee, which would be degraded to match the elevation of the island floor, at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. This alternative would result in adverse environmental impacts that would be less than those identified in Alternative 1, as the potential for fish strandings would be reduced. Benefits would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, reversal of land subsidence, and reduced OMRR&R requirements.

Use of Available Information

The DWR has completed studies, surveys, reports, permits, and engineering for the North Delta Flood Control and Ecosystem Restoration Project that includes the McCormack-Williamson Tract project. Existing information from DWR and data and reports from the CALFED Program will be used to the maximum extent possible and evaluated for data adequacy. The latest information will be incorporated into the study. The review effort will be used to determine whether the methods used, results obtained, and the uncertainties in the

analyses are acceptable based on Corps policies and guidelines, and sound scientific practices. Further, preparation of environmental documentation will be tiered to the 2000 CALFED Record of Decision.

CHAPTER 3. MANAGEMENT OF FEASIBILITY STUDY

GENERAL

CESPK and the non-Federal sponsor will be responsible for management of the MWTFS. Management of the study will be conducted at three basic levels: the PDT, Executive Committee, and CESPK Project Review Boards. The following is a description of each.

Project Delivery Team

The Corps has assembled a PDT for this study effort that includes representatives from the Corps, RD 2110, DWR, and several Federal and state agencies. This team will ensure appropriate scope of the studies, guide in their accomplishment, and develop and recommend potential solutions. CESPK participation on the team will include representatives from Programs and Project Management, Planning, Engineering, Real Estate, and other organizations as appropriate. The team will provide recommendations to the Executive Committee on the tasks to be conducted and extent of planning and evaluation to be carried out in the study phase. The team will also report to the Executive Committee on the results of studies and recommend alternative courses of action for study implementation.

PDT meetings will be held regularly throughout the study phase. Meetings will be held at approximately 1-month intervals, typically the third Tuesday every month, but may be more frequent depending on need. Current PDT members are listed in Tables 3-1 and 3-2.

Executive Committee

The Executive Committee will include the CESPK District Engineer (or designee), Planning Division Chief, Chief of Engineering Division, and Deputy District Engineer for Project Management. The non-Federal sponsor (RD 2110) and DWR will provide one representative each along with one primary technical advisor representing both RD 2110 and DWR. Collectively, those representing the sponsor will be equal partners with the Corps representatives on the committee. The District Engineer and counterpart representing the sponsor will assist in chairing the committee. The Executive Committee will manage the overall study by (1) maintaining a working knowledge of the feasibility study, (2) assisting in resolving emerging policy issues, (3) ensuring that evolving study results and policies are consistent and coordinated, (4) directing the PDT, and (5) ratifying decisions made by the PDT.

The Executive Committee will participate in the Alternative Formulation Briefing (AFB) and is responsible for resolving any disputes that may arise during the study. The committee will agree on the solutions and study direction, which may include termination. The AFB will be held prior to the public distribution of the draft PIR to ensure that all issues are resolved before the final report is submitted to higher authority. Current Executive Committee members are identified on Table 3-3.

Table 3-1. Project Delivery Team Members (USACE)

Name	Office	Office Code	Phone: (916) 557
Engineering Division			
Bob Collins	Water Management Section (ED-DW)	L2L0220	-7132
John High	Hydrology Section	L2L0220	-7136
Eugene Maak	Hydraulic Design Section (ED-DH)	L2L0210	-7020
Lea Adams	Acting Chief, Hydraulic Design Section (ED-HD)	L2L0210	-7143
Greg Kukas	Acting Chief, H&H Branch(ED-H)	L2L0200	-7255
Larry Nemetz	Civil Eng. Design Section A	L2L0610	-7269
Peter Valentine	Chief, Civil Eng. Design Section A	L2L0610	-6618
Wayne Smith	Soil Design (ED-GS) – Levee Stability	L2L0720	-5381
Ed Ketchum	Chief, Soil Design Geotechnical (ED-GS)	L2L0720	-5383
April Fontaine	Chief, Geology Section	L2L0730	-7699
Cory Koger	Environmental Chemistry Section (ED-EC)	L2L0960	-5112
John Esparza	Chief, Environmental Chemistry Section (ED-EC)	L2L0960	-7451
Mary Diel	Value Engineering Officer, Engineering Division, Support Branch, Cost Estimating Section (ED-SC)		-6833
Robert Vrchoticky	Cost Engineering Section	L2L0820	-7336
Joseph Yee	Chief, Cost Engineering Section	L2L0820	-6990
Casey Young	GIS & Mapping Section	L2L0840	-7158
Tom Sobolewski	Chief, GIS & Mapping Section	L2L0840	-7419
Planning Division			
Brooke Schlenker	Lead Planner, Water Resources Branch (PD)	L2K0400	-5299
Matilda Evoy-Mount	Planner, Water Resources Branch (PD)	L2K0400	-5322
John Jordan	Economic Risk Analysis Section(PD-WE)	L2K0400	-7267
Kurt Keilman	Chief, Economic Risk Analysis Section (PD-WE)		
Mark Cowan	Chief, Water Resources Branch (PD-WW)	L2K0400	-6721
Sannie Osborne	Chief, Cultural, Recreation, & Social Assessment Section (PD-RC)		
Doug Edwards	Environmental Planning Section (PD-RP)	L2K0510	-7026
Real Estate Division			
Jeremy Hollis	Acquisition & Management Branch, Real Estate (RE-B)	L2N0600	-6880
Stan Wallin	Chief, Acquisition & Management Branch, Real Estate (RE-B)	L2N0600	-5225
George Heubeck	Tech Services Branch (RE-A)	L2N0700	-7957
Public Affairs			
Tyler Stalker	Public Affairs (PA)	L2C0000	-5107
Office of Counsel			
Bob Scharf	Office of Counsel (OC)	TBD	-6619
Programs & Project Management Division			
Ofelia Sarmiento	Budget Analyst, Civil Programs Section (PM-C)	L2H0220	-7586
Carmen Routh	P2 Program Specialist, Programs Support & P2 (PM-P)	L2H0210	-7633
Dennis Clark	Project Manager, CALFED LSP, Civil Works Branch, PPMD (PM-C)	L2H0410	-7963

Table 3-2. Project Delivery Team Members (RD 2110/DWR/Resource Agencies)

Organization	Name/Title	Phone
The Nature Conservancy/RD 2110	Leo Winternitz Delta Project Manager/Trustee 8	(916) 449-2850 Ext. 4105
California Department of Water Resources	TBD Program Manager Delta Levees and Environmental Engineering FloodSAFE Environmental Stewardship and Statewide Resources Office	
US Fish and Wildlife Service	TBD	
CA Department of Fish and Game	TBD	
National Oceanic and Atmospheric Association	TBD	

Table 3-3. Executive Committee Members

Organization	Name/Title	Address	Phone
Corps of Engineers CESPK-DE	LTC Andrew B. Kiger District Engineer	1325 J Street Sacramento, CA 95814	(916) 557-7490
Corps of Engineers CESPK-PM	Kristina Mullins Deputy District Engineer for Project Management	1325 J Street Sacramento, CA 95814	(916) 557-7448
Corps of Engineers CESPK-PD	Alicia Kirchner Chief, Planning Division	1325 J Street Sacramento, CA 95814	(916) 557-6767
Corps of Engineers CESPK-ED	Rick Poeppelman Chief, Engineering Division	1325 J Street Sacramento, CA 95814	(916) 557-7623
RD 2110	Leo Winternitz Trustee	2015 J St., Ste 103 Sacramento, CA 95811	(916) 449-2850 Ext. 4105
Department of Water Resources (DWR)	Dave Mraz Chief, Delta Levees and Environmental Engineering, Division of Flood Management	1416 9th Street Sacramento, CA 95821	(916) 574-0385

MANAGEMENT DOCUMENTS

During the feasibility study, CESPK will prepare a series of reports and other information documents useful in the overall management of the study. These documents will be available to the sponsor and will serve as the record of study progress. The documents are described below.

Justification Sheet

The CESPK budget analyst and Project Manager prepare the justification sheet twice a year. It summarizes the study status, expenditures to date, and Federal budget requirements for the following year. This document is sent by the Corps to Congress to support the

President's annual budget request. After the President's budget is released for the fiscal year, the justification sheet will be released to the sponsor.

Monthly Status Report

The Corps Project Manager will update the status report monthly with assistance from PDT members. This report will also document all important dates and milestones, meetings, task completions, and expenditures for Federal and non-Federal funds as compared to budgets.

Funds Management Report

The budget analyst will update the funds management report monthly and distribute copies to the Corps Project Manager. This report documents budgets and expenditures for each task, resource, and budget type (hired labor, contracts, miscellaneous expenses, and others) for the current Federal fiscal year. At the end of each government fiscal year, a final funds management report is issued showing the total budgets, expenditures, and obligations for the fiscal year. The year-end report will be sent to the sponsor.

Schedule and Cost Change Request

A schedule and cost change request (SACCR) is the principal form that will be used to change the approved study cost or major study milestones. The Corps and sponsor representative on the PDT will review and agree to changes proposed by the SACCR before subsequent action by the appropriate level of approval in accordance with ER 5-7-1.

Scopes of Work

The Scope of Work (SOW) is the basic means of assigning work tasks during the feasibility study. A SOW will be issued for each work task described in this PMP. Each SOW will describe the scope and schedule for the task, as well as the funds provided to complete the task. The Project Manager will distribute study funding using the SOW system.

CHAPTER 4. FEASIBILITY STUDY PRODUCTS

GENERAL

The MWTFS will result in several study and construction project products. The primary study products are described below.

Project Implementation Report and EIS

This product includes all activities leading to the approval of the final PIR and Environmental Impact Statement (EIS) by CESPD. It entails all problem identification and formulation activities required to identify and recommend one or more alternatives. The PIR is the final version of the milestone conference documentation, which will be continually refined throughout the planning process. It also includes coordination of the study and results with all interested parties; District technical review; and review and approval by CESPD.

This product includes all activities leading to report approval by CESPD. It includes the NEPA, CEQA, and other environmental compliance documentation.

Letter of Intent and Statement of Financial Capability

As the details of the recommended plan are finalized, coordination will be undertaken with the local non-Federal sponsor to review the requirements of local cooperation. Letters of intent that acknowledge the requirements of local cooperation and express good faith intent to provide those items for the recommended plan will be developed. Additionally, self certifications of Financial Capability will be developed by the sponsor to meet its obligations under the Project Partnership Agreement (PPA) for construction of the recommended plan.

Other Supporting Plans

Other supporting plans will be developed as needed as the study progresses to address specific items such as local cooperation, real estate acquisition, quality control, environmental and cultural matters, safety and security, and OMRR&R.

TECHNICAL REQUIREMENTS

In the 2006 Report to Congress, the Corps concluded that: *"There is a serious need for short-term actions and a long-term strategy to improve levee stability in the Delta because people's lives, properties, and vital resources of statewide and national importance are threatened."* The Corps stated that the *"short-term strategy is to move quickly to construction on high priority levee reconstruction projects identified in this report."* (p. 17). In addition, both early CALFED studies and more recent State of California reports point out the critical need for levee stabilization.

Following through on the statements in the May 2006 Report to Congress, the Corps has made this program a high priority. The planning, design, and construction activities, and reporting and approval requirements, should be consistent with the following principles:

- That the CALFED Levee Stability Program projects are critical to meeting the flood risk management, ecosystem restoration, water supply, water conveyance, and water quality needs of the Delta and the State of California.
- That the protection of Delta's economic and agricultural productivity, and of its environmental resources, are important to the security, economic development, and environmental health of California and the United States, and as such provide a high economic and environmental return for the Nation.
- That the projects listed in the May 2006 report to Congress are already authorized by Section 103(f)(3)(A) of PL 108-361.
- Since CALFED Levee Stability projects will involve repairs of existing levees and are already authorized, they are not typical Corps projects and as such do not require the amount of planning and reporting that Corps feasibility studies demand. Therefore:
    1. Plan formulation activities should be constrained to only those solutions that directly address levee deficiencies and project purposes consistent with the 2006 Report to Congress.
    2. Maximize the use of already available data and analyses, and limit new planning activities to the minimum needed to identify the most cost-effective, technically feasible, justified, and environmentally acceptable project.
    3. Utilize the standardized report templates and the report review and approval processes identified in the Program Management Plan for the CALFED Levee Stability Program (PgMP).
    4. Minimize normal Corps requirements to justify projects consistent with the intent of Section 103(f)(3)(C) of PL 108-361, as amended by Section 3015(a) of WRDA 2007. Justification of a project only requires that it be cost-effective.
    5. Utilize the authority to make technical decisions on projects at the District level, and project approval decision at the Division level.

The work tasks and products described in this PMP are at a "feasibility level of effort", consistent with the guidance as stated above. Where applicable, the scope of studies in terms of content and level of detail for the evaluation phase are defined and required by, but not limited to, the following documents:

CECW-PC	Implementation Guidance for Section 2039 of the Water Resources Development Act of 2007 (WRDA 2007) – Mitigation for Fish and Wildlife and Wetlands Losses	31 Aug 2009
CECW-HS	USACE National Flood Risk Management Program Initial Guidance	5 Oct 2009
DM 1165-2-501	Surveying and Mapping	Dec 1999
EC 11-1-114	Value Management (VM)/Value Engineering (VE)	3 Feb 2003
EC 1105-2-404	Planning Civil Works Project Under the Environmental Operating Principles	1 May 2003
EC 1105-2-405	Division Engineers Submittal of Final Decision Document for Projects Requiring Specific Authorization	31 Mar 2005

EC 1105-2-406	District Engineers Presentation of Final Decision Document for Projects Requiring Specific Authorization	31 Mar 2005
EC 1105-2-407	Planning Models Improvement Program: Model Certification	31 May 2005
EC 1105-2-408	Peer Review of Decision Documents	31 May 2005
EC 1105-2-409	Planning in a Collaborative Environment	31 May 2005
EC 1105-2-410	Review of Decision Documents	22 Aug 2008
EC 1165-2-209	Civil Works Review Policy	31 Jan 2010
EC 1165-2-211	Water Resources Policies and Authorities, Incorporating Sea-Level Change Considerations in Civil Works Programs	1 July 2009
EM 1110-2-1411	Standard Project Flood Determination (ENG BUL 52-8)	01 Mar 1965
EM 1110-2-1413	Hydrologic Analysis of Interior Areas	15 Jan 1987
EM 1110-2-1415	Hydrologic Frequency Analysis	05 Mar 1993
EM 1110-2-1416	River Hydraulics	15 Oct 1993
EM 1110-2-1417	Flood Runoff Analysis	31 Aug 1994
EM 1110-2-1419	Hydrologic Engineering Requirements of Flood Damage Reduction Studies	31 Jan 1995
EM 1110-2-1420	Hydrologic Engineering Requirements of Reservoirs	31 Oct 1997
EM 1110-2-1602	Hydraulic Design of Reservoir Outlet Works	15 Oct 1980
EM 1110-2-1603	Hydraulic Design of Spillways	16 Jan 1990
EM 1110-2-3600	Management of Water Control Systems	30 Nov 1987
ER 5-1-11	Programs and Project Management	17 Aug 2001
ER 11-1-321	Army Programs Value Engineering	28 Feb 2005
ER 200-2-2	Procedures for Implementing NEPA	4 Mar 1988
ER 405-1-12 (Ch. 12)	Real Estate Handbook - Local Cooperation	1 May 1998
ER 1105-2-100	Planning Guidance Notebook	22 Apr 2000
ER 1110-1-12	Quality Management	1 Jun 1993
ER 1110-2-1150	Engineering and Design for Civil Works Projects	31 Aug 1999
ER 1110-2-1302	Engineering and Design, Civil Works Cost Engineering	31 Mar 1994
ER 1110-2-8154	Water Quality and Environmental Management for Corps Civil Works Projects	31 May 1995

ER 1130-2-530	Project Operations, Flood Control Operations, & Maintenance Policies	30 Oct 2002
ER 1130-2-540	Environmental Stewardship, Operations & Maintenance Policies	Nov 1996, Nov 2002
ER 1130-2-550	Recreation Operations & Maintenance Policies	Nov 1996, Nov 2002
ER 1165-2-119	Modifications to Completed Projects	20 Sep 1982
ER 1165-2-131	Local Cooperation Agreement for New Starts	15 Apr 1989
ER 1165-2-132	Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects	26 Jun 1992
ER 1165-2-206	Delegation of Review, Approval, and Signature Authority for Project Cooperation Agreements for Specifically Authorized Projects	30 Jan 2004
ER 1165-2-400	Recreational Planning, Development, and Management Policies	9 Aug 1985
ER 1165-2-501	Water Resources Policies and Authorities, Civil Works Ecosystem Restoration Policy	30 Sep 1999
ER 1165-2-205	Delegation of Review and Approval Authority for Post- Authorization Decision Documents	31 Mar 2004
ETL 1110-2-556	Risk-Based Analysis in Geotechnical Engineering for the Support of Planning Studies	May 1999
ETL 1110-2-571	Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures	10 Apr 2009
U.S. Water Resources Council	Economic and Environmental Principles and Guidelines Council Publication for Water and Related Land Resources Implementation Studies	10 Mar 1983
CESPD-R-1110-1-8	CESPD Quality Management Plan	Sep 2004
CESPK-01-B	Sacramento District Quality Management Plan Appendix B, QMP for Planning	Mar 2004

CHAPTER 5. STUDY COST ESTIMATE AND TASKS

STUDY COST AND CONTINGENCY

The initial cost of $100,000 to prepare the PMP, initiate the PIR, and negotiate the FCSA was solely Corps responsibility, consistent with the Corps implementation guidance for WRDA 2007 and is not included in the cost share for the MWTFS.

Estimated costs to accomplish the Feasibility Study are required to be shared between the Corps and the non-Federal sponsor on a 50-50 basis. Section 225 of the Water Resources Development Act of 2000 changed the cost-sharing requirements so that the non-Federal sponsors may now provide the entire share of feasibility study costs as in-kind services. The non-Federal sponsor will provide in-kind work as described in the individual study tasks in this chapter. The current total estimated study cost is **$2,914,000**. Table 5-1 shows a summary of the feasibility study cost by task and the separation of the costs between the Corps and sponsor. The Corps 100 percent responsibility for the cost of conducting an Independent External Peer Review (IEPR) of $300,000, consistent with the Corps Headquarters Implementation Guidance for WRDA 2007 is not included in the non-Federal sponsor 50-50 share. Table 5-2 shows the estimated non-Federal sponsor cash contribution as will be stated in the FCSA, while Table 5-3 shows Federal and total study costs. Table 5-4 shows the estimated costs separated by Federal fiscal years. It is important to note that the actual cost estimate may change, subject to the iterative nature of the planning process.

Table 5-1. Feasibility Study Cost Summary by Organization ($1000)

Task	Federal	Sponsor	Total
	Labor & Other	Labor & Other	
Project Management, P2, and Budget Analyst	185	20	205
Plan Formulation, Evaluation, and Coordination	213	20	233
Public Involvement, Coordination, and Outreach	28	10	38
Environmental Studies and Report	235	40	275
Historical/Cultural Resources Studies, Coord. & Report	20	5	25
GIS, Mapping, and Graphics, Data Management Plan	22	5	27
Hydrology & Hydraulics Studies and Reports	116	5	121
Engineering Design Analysis and Report; Civil Design	512	15	527
Landscape Architecture	25		25
Geotechnical Studies & Report	446		446
Geology Studies & Report	30		30
Real Estate	75	10	85
HTRW Assessment and Report	70		70
Economic Impact Analysis and Report	12		12
Cost Estimates and Report	32		32
Sponsor's Technical Review		60	60
Value Engineering	40		40
Agency Technical Review	25		25
LSP Program Costs	55		55
Conducting and Reporting of IEPR	45		45
Subtotal	**2,186**	**190**	**2,376**
Contingency (10%)	219	19	**238**
Cost Shared Total	**2,405**	**209**	**2,614**
50% Cost Share	**1,307**	**1,307**	**2,614**

Table 5-2. Non-Federal FCSA Costs ($1000)

Non-Federal FCSA Costs	
	Non-Federal
50% Cost Share	1,307
FCSA Articles III & VI[4] (credit)	50
Non-Federal In-Kind Contributions	209
Additional Non-Federal Cash Required	**1,048**
Total Non-Federal Contribution (Excluding Articles III and VI)	1,257
Non-Federal Proportionate Share	49.02%

Table 5-3. Federal FCSA Costs ($1000)

Federal FCSA Costs	
	Federal
50% Cost Share	1,307
Application of FCSA Articles III & VI (credit to Non-Federal Sponsor)	1,357
Independent External Peer Review	300
Total Federal Costs	**1,657**
Total Cost for Entire Study	**2,914**

Table 5-4. Feasibility Study Cost ($1000) Summary by Fiscal Year

	Federal Share	**Non-Federal Share**	**Total Cost**
FY11	545	414	959
FY12	1,112	843	1,955
Total	**1,657**	**1,257**	**2,914**

A study contingency is assigned to cover unforeseen study requirements and uncertainties in the study cost estimate. These may have resulted from the limited information available during the development of the PMP. A ten (10) percent contingency will be added to the overall study cost estimate to cover unexpected additional costs such as modified alternatives and/or more extensive analysis of alternatives. Approval from the Executive Committee is required before these contingency funds can be used in this feasibility study.

[4] FCSA Articles III & VI (Sponsor's Coordination and Audits). The non-Federal sponsor will attend Study Coordination Team meetings with the Corps Project Manager and other assigned executives, as listed in Chapter 3, Table 3-2. The Study Coordination Team will meet regularly until the end of the study period to keep the Study Coordination Team informed of the progress of the study and of significant pending issues and actions. In addition, the non-Federal sponsor and the Corps Project Manager shall develop procedures for keeping books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the FCSA. The Corps and the non-Federal sponsor shall maintain such books, records, documents, or other evidence in accordance with these procedures for a minimum of three years after completion of the accounting. To the extent permitted under applicable Federal laws and regulations, the Corps and the Non-Federal sponsor shall each allow the other to inspect such books, records, documents, or other evidence**.**

DETAILED DESCRIPTION OF STUDY TASKS

This section describes the tasks to be accomplished during this feasibility study phase. These descriptions are based on the evaluation, investigation, and alternatives analysis during the study phase to assess the problems, opportunities, and potential solutions for the McCormack-Williamson Tract project. The scope and cost of these tasks are subject to change during the study as more information becomes available.

At the beginning of each task, either CESPK or the sponsor may review any planned in-kind work or contract of the other for adequacy. At the conclusion of each task, either CESPK or the sponsor may review and approve the results of the work before it is considered complete. Review and assessment of the adequacy of the task will be the responsibility of the PDT and its technical staff.

Programs and Project Management, (Includes P2 (Primavera) Scheduling, and Budget Analyst)

The Program and Project Management Division of CESPK will accomplish this task with assistance by the sponsor. The task primarily includes project management. It also includes preparation of monthly reports, budget documents, contract coordination, pre-construction engineering and design cost-sharing agreement, PMP, final audit, and sponsor letter of intent. These tasks are described below.

1. Project Management: CESPK will perform this task with support from the sponsor. Project management tasks will involve day-to-day management of the execution of the MWTFS. This will include monitoring the schedule and budget, setting the agenda for and conducting project management team meetings, coordinating with and writing SOWs to CESPK technical elements, writing miscellaneous correspondence, and preparing monthly status reports and other documents as required. Similar requirements will be necessary for upward reporting by the sponsor. The Corps Project Manager will be the primary point of contact for the non-Federal sponsor and is responsible for the overall execution of the PIR. The Corps Project Manager will coordinate with other team members and the sponsor, attend other meetings as appropriate, monitor study execution and expenditures, and update the CESPK Project Review Board (PRB) of study progress.

2. Project and Programs Management Documentation: A number of project related documents will be required as part of accomplishing the PIR. They primarily include:

Milestone Deliverables:

- **Trip Report**: This report summarizes the results of a site visit and identifies any major engineering and design elements requiring consideration in preparation of the Preliminary Draft Project Implementation Report.
- **Preliminary Draft Project Implementation Report** (PDPIR): This task provides a summary of the alternatives that are proposed for consideration, a description of the site and anticipated future without project conditions, identification of key technical issues and a conceptual cost estimate for the alternatives.
- **Project Management Plan** (PMP): The Corps Project Manager will coordinate this task with input from all CESPK elements and the sponsor. The PMP will include the

tasks, schedules, costs and management framework, and direction for the PDT for the study phase.

- **Project Fact Sheet**: Developed by CESPK, this two-page summary document describes the problem(s) to be addressed, identifies the federal interest, the alternative proposed to be analyzed, major technical issues to be addressed, and a map of the project area.
- **Feasibility Cost-Sharing Agreement** (FCSA): Developed by CESPK in conjunction with the local sponsor, the FCSA identifies the tasks to be undertaken, the costs associated with those tasks, and the contributions of the local sponsor for each task.
- **PPA Agreement:** CESPK with input from the sponsor will prepare outlines of the cost-sharing obligations for the PPA phase. The draft agreement will be submitted with the draft PIR. The draft PPA will be revised based on comments received at the AFB Conference. The revised PPA will be submitted to the District PRB for approval. This task will require close coordination between the CESPK Project Manager and the sponsor.
- **Sponsor's Letters of Intent:** The sponsor will review what its rights and responsibilities would be during the PPA and Construction phases, and if agreed upon, will prepare a letter expressing intent to cost share the cost of design and construction of the selected plan, and to operate and maintain the completed project. In the letter, the sponsor will express its understanding of cost-sharing responsibilities regarding design, construction, and OMRR&R. The execution of any such letter is subject to the sponsor's internal review process and receipt of all necessary internal and external approvals. The program manager will assist the sponsor in this task by providing examples and explaining the role and responsibilities of the non-Federal sponsor.

Administrative Reports

- **Monthly Reports Preparation:** CESPK will update the periodic reports listed in Chapter 3 under "Management Documents." The monthly reports will include the Project Executive Summary Report, justification sheet, and SACCRs.
- **Budget Documents and Financial Reports:** CESPK will prepare monthly Funds Management Reports and other budget documents for use by the PDT. This task will require coordination with the Corps Project Manager to explain expenditures and develop spending schedules. The sponsor will coordinate with CESPK to keep the Corps apprised of the sponsor's spending performance.
- **Final Audit Preparation:** CESPK will prepare a final audit to ensure that local contributions are at their proper level and settle any debts or credits.

Responsible Sacramento District Element:		
	Programs and Project Management Division, Civil Works	
Cost:		
	Sponsor's In-Kind Contribution:	$20,000
	Sacramento District:	$185,000
	Current Total Estimated Cost:	**$205,000**

Plan Formulation, Evaluation, and Coordination

This document describes scope, schedule, and budget for continued efforts to be performed upon signing of the FCSA, in recognition of planning efforts that have occurred in the recent past, primarily DWR's efforts to address flood risk management issues and ecosystem restoration on McCormack-Williamson Tract. The Planning Division of CESPK will have responsibility for these tasks. A planning team will be assembled whose task will be: coordination, development and oversight of the PIR and associated documentation; agency technical review coordination; and quality assurance to ensure compliance with Corps planning procedures and policy, in cooperation with the Project Manager, other PDT elements, sponsor, District Support Team (DST), and Agency Technical Review (ATR). This effort will include ongoing study management, coordination, meetings, correspondence, and public involvement activities with the sponsor, contractors/ consultants, stakeholders, elected officials, cooperating agencies, and the public (organizations, groups, and individuals). The planning team will support, facilitate, and expedite processing documents with CESPD, consistent with Corps policy, the CALFED Levee Stability Program streamlined planning process as authorized by the Headquarters Implementation Guidance for WRDA 2007, and through CESPD's approval of a Record of Decision (ROD) and Final EIS. Major responsibilities of the planning team include:

- Accomplishment of planning tasks in accordance with the Federal planning process and implementation guidance for the CALFED Levee Stability Program under WRDA 2007;
- Participation in public involvement and agency coordination;
- Review pertinent available information and collection of new information;
- Formulate, refine, evaluate, and compare alternatives;
- Prepare and process AFB conference or equivalent;
- Support in the preparation draft and final PIRs and associated documentation;
- Support ATR and Value Engineering responsibilities; and
- Support CESPD review activities.

Specific responsibilities of the planning team towards the above activities are covered in other sections of this Chapter. Tasks specific to the plan formulation function by the planning team include the following:

1. PMP & FCSA Preparation: The planning team will work with the Corps Project Manager and attend meetings with the CESPK staff and the non-Federal sponsor to prepare and review the PMP and FCSA.

2. Planning Study Coordination and Meetings: The planning team will develop, coordinate, and execute the planning program for the PIR, related resource requirements (PMP scope, schedule, and budget), and documentation in coordination with the Corps Project Manager, PDT, sponsor, and others, similar to the F1 through F9 planning processes, but shortened as directed in the Headquarters Implementation Guidance for the Water Resources Development Act of 2007 – Section 3015 (WRDA 2007). The planning team will also provide expert guidance, advice, and leadership on technical planning requirements and policies. The team will ensure that the Federal/Corps planning process is effectively executed and documented, as modified by U.S. Army Corps of Engineers Headquarters Implementation

Guidance for WRDA 2007. The planning team will participate in meetings in coordination with the Corps Project Manager, other PDT elements, ATR, sponsor, contractors, concerned agencies, stakeholders, the public, officials, Corps echelons, and others. The team will communicate and correspond as needed, as well as advise and support Corps and/or sponsor contract managers and points of contact with execution of the work. The planning team will ensure compliance with pertinent planning regulations, policies, guidance, and quality management plans and practices. The team will prepare for and participate in site visits, meetings, correspondence, and other actions as needed. The planning team will review, revise, and comment on: the PMP and PMP updates; schedules; SOWs; pertinent technical studies, reports, data, and other products and publications; meeting presentations and summaries; and contract SOWs and modifications.

3. Plan Formulation: The planning team will be responsible for all phases of formulation and evaluation of alternative plans leading to development of a selected plan for the PIR. The PDT will affirm problems, opportunities, study objectives and constraints, as well as the development of initial alternatives and management measures in the PDPIR. For the remainder of the study effort, the planning team will focus on the following activities:

- **Identify Problems, Opportunities, and Study Objectives and Constraints** – The planning team will review DWR's existing planning information related to the project, other pertinent studies, reports, and available information, as well as to coordinate with other Federal and non-Federal interests to define baseline planning conditions. This effort will include defining the future without-project conditions in the study area, identifying and describing resources problems and needs, preparing a set of specific study objectives to address the problems and needs, and developing planning criteria specific to the primary study area that will guide the plan formulation process.
- **Resources Management Measures and Initial Alternatives** – The planning team will review existing management measures that could address the study objectives, as well as identify any additional appropriate and practical resources. The team will screen these measures and prepare a set of initial alternatives to address the study objectives. Using available information, the planning team will compare and evaluate the initial alternatives to identify which could be considered for further development. These initial alternatives and other developed information will be assembled in documentation for use in subsequent plan formulation tasks.
- **Continue Refinements and Evaluate Alternatives:** Based on input from the non-Federal sponsor and resources agencies, the planning team will refine and screen management measures and initial alternatives, as well as assess the feasibility of each measure to stabilize levees within the primary study area in relation to the evaluation criteria. The planning team will review and revise problem and opportunity statements, inventories and forecasts of resources, and existing and future without-project conditions. The team will refine the planning objectives, constraints, and evaluation criteria for management measures (features and actions) and alternatives. The team will also refine and reformulate alternatives, and support the completion of narrative descriptions and illustrations for each plan to be considered in detail. The PDT planning team will closely coordinate with other PDT elements to develop more detailed cost estimates, assess environmental effects and costs to mitigate effects, and then identify and quantify benefits of alternatives. The planning team will evaluate and compare alternatives based on the evaluation criteria - cost effectiveness. This will include (1) assessing and evaluating potential

effects of each alternative; (2) comparing effects of all alternatives; (3) ranking alternatives; and (4) identifying the recommended plan based on cost effectiveness. Alternatives and other developed information will be assembled in report-like format and for use at the AFB Conference.

- **Continue Plan Formulation and Evaluation, and Focus on Recommended Plan and AFB Policy Issues:** Based on input from the non-Federal sponsor and PDT, the planning team will further develop, refine, evaluate, and compare alternatives, and identify the most cost-effective plan and the recommended plan. The team will identify preliminary cost allocations and develop cost-sharing responsibilities. The planning team will coordinate more detailed cost estimates, assess environmental effects and costs to mitigate those effects, and then refine and quantify benefits of alternatives. The planning team will compare plans and effects, including cost-effectiveness, conduct a trade-off analysis, identify the recommended plan, and provide rationale. The team will identify known technical and/or policy issues and recommend actions to resolve these issues (describe issue, background, options, and assessment, and recommend action).
- **Continue Plan Formulation for PIR and EIS:** Based on the Project Guidance Memorandum (PGM) from the AFB (see **Appendix C**) and input from non-Federal sponsor and PDT, the planning team will revise or revisit the plan formulation for the draft PIR and EIS. The team will coordinate the PDT to refine details of the recommended plan, cost allocation, and cost-sharing responsibilities; organize appendixes; and refine cost estimates and assessments of environmental effects and costs to mitigate for effects. The planning team will refine benefits and costs of the alternatives and the comparison of effects. The team will recommend the best plan based on evaluation criteria and identify the recommended plan and rationale.

4. Prepare and Process Pre-Conference Documentation, and Convene Alternatives Formulation Briefing: The planning team, in conjunction with the rest of the PDT, will prepare for and conduct the AFB or equivalent conference. The team will discuss technical and/or policy issues and recommend actions to resolve these issues.

5. PIR to CESPD: The planning team will prepare, in conjunction with the rest of the PDT, the Draft and Final PIRs and EIS, and supporting technical and legal certifications or compliance memoranda, to CESPD in accordance with Corps Headquarters Implementation Guidance for the Water Resources Development Act of 2007 – Section 3015 (WRDA 2007).

Responsible Sacramento District Element:	
Planning Division, Water Resources Branch	
Cost:	
Sponsor's In-Kind Contribution:	$20,000
Sacramento District:	$213,000
Current Total Estimated Cost:	**$233,000**

Public Involvement, Coordination, and Outreach

The Planning Division of CESPK will be responsible for this task; however, it will be conducted jointly by CESPK and the non-Federal sponsor. This task will consist primarily of a public scoping meeting to solicit comments on the draft PIR and EIS. Detailed task descriptions follow.

1. Communication Plan: The PDT will develop and execute a communication plan in accord with current Corps policy to effectively reach the affected community. The plan will result in development of key messages; promote a work climate that is open, informed, and actively engaged in listening and being responsive; build effective relationships; and integrate strategic communications into our business process. The Draft Communication Plan is included as **Appendix D**.

CESPK and the sponsor will prepare and disseminate required public notices in accordance with NEPA and other pertinent laws and policy. In addition, CESPK will develop and maintain a mailing list for the notices.

2. Public Meeting(s): CESPK will update the mailing list and prepare the public scoping meeting invitation with input from the sponsor. The invitation will include a summary of the Draft PIR and Draft EIS, a description of alternatives, and meeting information. CESPK will print and distribute the invitation. The purpose of the public meeting is to provide an opportunity for public comment on the draft PIR and EIS. CESPK, with input from the sponsor, will plan and set the agenda for the meeting/workshop, develop and deliver the presentations, set up and staff a sign-in table, and provide audio-visual equipment and other materials. The sponsor will provide a facility for the meeting, along with other requested materials and supplies, and perform recording duties. CESPK, with input from the sponsor, will organize and conduct the meeting and prepare any visual displays. CESPK, with input from the sponsor, will prepare a memorandum documenting the meeting.

The planning team will coordinate with CESPD and prepare the supporting documentation as needed for publication of the public notice that the final PIR and EIS is available for public consideration (draft notice and mailing list).

Responsible Sacramento District Element:	
Planning Division, Water Resources Branch	
Cost:	
Sponsor's In-Kind Contribution:	$10,000
Sacramento District:	$28,000
Current Total Estimated Cost:	**$38,000**

Environmental Studies and Report

The Planning Division of CESPK (Environmental Planning Section of the Environmental Resources Branch) will be responsible for completing these tasks, with input from the sponsor and resource agencies (USFWS, NMFS, and California Department of Fish and Game (DFG)). During the course of the study effort, the Environmental Resources Branch will participate as a member of the PDT and prepare and present briefings; update SOWs and budget estimates as

required; participate in the preparation of the Real Estate Supplement and the feasibility of construction designs; participate in assembling the study PDT and ATR teams; assist in completing the ATR process, public/interagency review, and preparation of required documents. This effort involves attending PDT meetings as required. Work will include all environmental analyses including the Habitat Evaluation Procedure (HEP). Existing scientific and technical data will be used from the DWR Draft Environmental Impact Report (EIR) for the North Delta Flood Control and Ecosystem Restoration Project (November 2007). Where information is not available, new scientific and technical research will be undertaken as necessary to ensure that the appropriate data is available to support planning efforts identified during the study.

1. Public Scoping Activities: CESPK along with support from the sponsor will conduct a scoping meeting as part of this effort to receive comments and other information from the public meeting described in the previous task (Public Meetings). In addition, CESPK will prepare an Environmental Scoping Report (ESR) to include comments received at the scoping meeting, written comments in response to the Notice of Intent (NOI), and responses the comments. The ESR will also include assessment of the responses along with recommendations for inclusion into the planning process for the PIR. The ESR will be made available to interested agencies and individuals.

2. Plan Formulation Participation: CESPK along with support by the sponsor will perform this task. It includes: participating in developing alternatives, evaluation and comparison of alternatives, including cost-effectiveness; general coordination with other elements; attending study team meetings; and providing advice on environmental aspects of alternatives. It is estimated that for the PIR, along with flood risk management, alternatives will include a focus on ecosystem restoration. Accordingly, this task includes support in formulating and evaluating plans for these purposes, and informing the preparation of the EIS. This task includes assisting in the development and determination of the most cost-effective plan.

3. Environmental Analysis: This task will be accomplished by CESPK with support from the sponsor and use of available studies and reports completed by DWR for the North Delta Flood Control and Ecosystem Restoration Project, as appropriate. It includes identification of impacts, restoration benefits, and potential mitigation features of alternative plans. Tasks include:

- **Participate in HEP Team:** The HEP team will determine the models appropriate for determining effects to habitat types within the project impact area. The team will use components of the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) to inform the selection of HEP models, as necessary. The team will consist of at least one representative from the DFG, NMFS, DWR, CESPK, RD 2110, and USFWS. The USFWS will be the lead on the team and conduct modeling. The work will include attending meetings, mapping fieldwork to assess habitats, choosing indicator species, and identifying mitigation alternatives.
- **Endangered Species Act (ESA) Coordination**: Complete the Section 7 process to satisfy the ESA; consult with the USFWS and NMFS under Section 7, and prepare a Biological Assessment (BA). The BA will rely on the Multi-Species Conservation Strategy (MSCS) used for the North Delta Flood Control and Ecosystem Restoration Project and other projects tiered to the 2000 CALFED Record of Decision (ROD) for the Programmatic Environmental Impact Study/Report (PEIS/PEIR) to satisfy the ESA Section 7 requirements. In accordance with the MSCS, the North Delta Action

Specific Implementation Plan (ASIP) was prepared and will be used by CESPK as the BA for this task.

- **Mitigation Plan Development:** Based on reported effects, develop rough estimates of required mitigation and mitigation costs for dual-purpose flood risk management and ecosystem restoration plans; develop a more detailed mitigation plan and costs for the most cost-effective plan or the recommended plan. The sponsor will select alternative mitigation sites for consideration, subject to approval by the Corps.
- **Wetland Delineation:** This task includes review the existing delineation completed in 2004 for the DWR Draft EIR for the North Delta Flood Control and Ecosystem Restoration Project (November 2007), field confirmation of the wetland delineation, mapping, and report preparation.
- **Water Quality:** The Clean Water Act requires a Section 404(b)(1) analysis to determine the extent of water quality effects. The Section 404(b)(1) water quality effects analysis will be included in the environmental documentation and be used to apply for water quality certification from the Regional Water Quality Control Board.
- **Categorical Exclusion/Exemption:** CESPK will prepare a Categorical Exclusion and Categorical Exemption to comply with NEPA and CEQA requirements, respectively, for the geotechnical surveys (see Geotechnical Studies and Report tasks below) that may include borings, cone penetration tests, and exploratory trenches.

4. Draft PIR and EIS Preparation: An EIS will be prepared for the project using information provided in the DWR Draft EIR for the North Delta Flood Control and Ecosystem Restoration Project (November 2007), to the extent possible. Further, the EIS will be tiered from the 2000 CALFED Record of Decision for the PEIS/PEIR. This task will be accomplished primarily by CESPK with support from the sponsor. It includes compliance with NEPA, and other federal environmental related regulations; organize and format data; and describe alternatives, including construction durations and borrow and disposal areas. CESPK will assemble the draft PIR and EIS. Reproduction and distribution of reports are also included in this task.

5. Final PIR and EIS Preparation: This task will be accomplished primarily by CESPK with support from the sponsor. It includes reviewing and drafting responses to comments received on the draft PIR and EIS, and incorporating changes based on the responses into the final PIR and EIS. Reproduction and distribution of reports are also included in this task.

6. ROD: The Corps' Environmental Planning Section will prepare the draft ROD submit it to the CESPD.

Responsible Sacramento District Element:	
Planning Division, Environmental Planning Section	
Cost:	
Sponsor's In-Kind Contribution:	$40,000
Sacramento District:	$235,000
Current Total Estimated Cost:	**$275,000**

Historical/Cultural Resource Studies, Coordination, and Report

The Planning Division of CESPK (Cultural, Recreation, and Social Assessment Section) will be responsible for completing these tasks. The tasks include using the existing cultural resources survey and reports that DWR prepared for the McCormack-Williamson Tract project detailing the cultural resources and effects as part of its North Delta Flood Control and Ecosystem Restoration project.

1. Cultural Resources and Effects: CESPK will review existing cultural studies and reports within the study area for the DWR North Delta Flood Control and Ecosystem Restoration project. This scope assumes that DWR's cultural resource survey was conducted in accordance with the standards defined in the Office of Historic Preservation's *Archeological Resource Management Reports: Recommended Contents and Format* (1990). CESPK will confirm the survey evaluated any nearby structures to determine if there are culturally significant resources that could be affected by the project. The DWR record search will be reviewed for any previously identified cultural sites, in accordance with the National Historic Preservation Act of 1966 (NHPA). CESPK will perform additional surveys and records search of the study area, including a search of the State Lands Commission shipwreck database, as needed to supplement and update the DWR cultural resources report.

2. Tribal Coordination: CESPK, along with the sponsor, will coordinate with local tribes as appropriate, on potential cultural sites within the study area, if applicable. Letters were sent to the Native American Heritage Commission (NAHC) and local tribes by DWR for Tribal consultation on potential Native American resources in the study area; however, no response was received by DWR. The Corps will send an additional letter to the NAHC with the latest description of activities and alternatives.

3. Project Delivery Team Participation and Support of the PIR and EIS: The Corps will use existing information from DWR's cultural resources survey, report, and Tribal consultation to facilitate the completion of this task. All work will be in accordance with the National Historic Preservation Act of 1966, as amended, and the provisions Section 15064.5 of the California Environmental Quality Act Guidelines, and the California Public Resources Code 21083.2. Using DWR's cultural resources report, CESPK will prepare and submit a report to SHPO for Section 106 concurrence, as required by NEPA. The Cultural, Recreation, and Social Assessment Section shall assist and support the PDT by attending meetings as needed, coordinating with the sponsor and DWR, and assisting in preparation of the draft and final PIR and EIS.

Responsible Sacramento District Element:	
Planning Division, Cultural, Recreation, and Social Assessment Section	
Cost:	
Sponsor's In-Kind Contribution:	$5,000
Sacramento District:	$20,000
Current Total Estimated Cost:	**$25,000**

GIS, Mapping, and Graphics, Data Management Plan

The Engineering Division of CESPK will be responsible for these tasks, with input from the sponsor. This task includes mapping for floodplain delineation where feasible, and generation of maps and graphics for documents clarification, public workshops, and other presentations throughout the PIR process. To the maximum extent possible, existing information will be used to define conditions in the MWTFS study area. The sponsor will provide any existing data sets regarding geotechnical data or any other applicable data sets for the study area. The North American Vertical Datum of 1988 (NAVD88) shall be used for all data gathered for this project.

1. Geospatial Data Management Plan (See Appendix E)

The Geospatial Data Management Plan (GDP) integrates geospatial data management into the Project Management Business Process (PMBP) and facilitates the implementation of enterprise data management. This data collection and management plan covers Computer Aided Design and Drafting (CADD) and Geographic Information System (GIS) products. Implementation of this plan will allow project delivery teams (PDTs) comprised of experts from various districts to work collaboratively on a project. For this collaboration to become a reality, the Corps must follow established criteria, policy and guidance for the acquisition, processing, storage, distribution, and use of geospatial data. Project delivery team members who are responsible for collecting spatial data and producing CADD and GIS products have a major role to play in the success of this effort.

2. Project Delivery Team Participation and Support of the PIR and EIS

If the data does not exist, PDT members requiring the data shall be responsible for writing the scope of work for collection and delivery. The geospatial specialist shall assist with the scopes as needed and/or review them to insure that the data is collected and delivered in accordance with the standards specified in the GDP. The geospatial specialist and applicable PDT members shall insure that the data obtained from external sources is used appropriately with regard to any licensing or security issues. The geospatial specialist shall assist and support the PDT by attending meetings, coordinating with other agencies, meeting compliance requirements in the GDP, and providing maps and figures in preparation of the PIR and EIS by preparing the required data products.

Responsible Sacramento District Element:	
Engineering Division, GIS/Survey Section	
Cost:	
Sponsor's In-Kind Contribution:	$5,000
Sacramento District:	$22,000
Current Total Estimated Cost:	**$27,000**

Hydrology and Hydraulics Studies and Report

The Engineering Division of CESPK will be responsible for assuring this task is completed according to Federal guidelines. Existing hydrologic and hydraulic (H&H) studies,

modeling, and related investigations have been completed for the DWR Draft EIR for the North Delta Flood Control and Ecosystem Restoration Project (November 2007). The details of the investigations and modeling will be provided to CESPK in a technical report and electronic data files. CESPK will review the H&H technical report and data from DWR and the conduct and results of the H&H studies will be documented in an Engineering Appendix to the PIR. CESPK will coordinate with DWR to refine the H&H studies as it relates to potential changes in design of the alternatives.

The North American Vertical Datum of 1988 (NAVD88) shall be used for all data gathered for this project.

1. Data Review and Modeling: CESPK will coordinate with RD 2110/DWR to acquire existing MIKE11 modeling studies, reports, and data on the project for technical review. This task first includes reviewing existing modeling studies, acquiring field information, such as the most recent available bathymetry and topographic data, for hydrologic, hydraulic, and sediment analyses, and then verifying the modeling results. For the purposes of this scope it is assumed that the modeling provided by RD 2110/DWR will be sufficient for CESPK to successfully convert MIKE11 to Hydrologic Engineering Centers River Analysis System (HECRAS). Existing Hydrologic data will be converted into NAVD88 datum upon validation of the data and modeling results. Subsequently, CESPK will perform 3-dimensional modeling to evaluate the selected alternatives and ensure that modeling results are appropriate for the detailed alternative formulation and evaluation mentioned below.

2. Hydrologic and Hydraulic Appendices*:* Separate technical H&H appendices will be prepared by CESPK conforming to ER 1110-2-1150, Engineering and Design for Civil Works Projects, dated 31 August 1999. The appendices will present a description of the data used, methods, assumptions, and results, and will be prepared as an appendix to an overall study report.

- Analytical methods – Methods of analysis, supporting reasons for adopting selected methods, and associated relationships to features selection will be discussed. Model development, calibration, verification, and application will be presented in detail. Computer programs used in the study will be described.
- Modeling applications – The report will present the hydrodynamic characteristics of each flow conveyance feature, including channel velocities, flow distributions, and water surface profiles or contours as determined from the modeling efforts. Significance of all modeling assumptions will be discussed in sufficient detail to address operation and maintenance and other future conditions.
- Uncertainties – A discussion of uncertainties will be included in the report, as well as how those uncertainties relate to feature development or operation and maintenance issues. The uncertainty discussion will also relate to the potential for more detailed analysis as details of alternatives are developed.
- Results and interpretations – The report will not only present hydrologic and hydrodynamic details of the modeling effort, but also a full engineering interpretation of those results. This interpretation will include descriptions of performance and function of the system for the full range of possible scenarios.

- Format – The format of the Engineering Documentation Report will conform to ER 1110-2-1150, Engineering and Design for Civil Works Projects, dated 31 August 1999.

3. Project Delivery Team Participation and Support of the PIR and EIS: The Engineering Division and applicable PDT members shall insure that the H&H data and reports obtained from external sources and the sponsor is used appropriately with regard to assessing impacts for the different alternatives. The Engineering Division shall assist and support the PDT by attending meetings, coordinating with the sponsor and DWR, and assisting in preparation of the draft and final PIR and EIS by providing interpretation of H&H modeling results to set baseline conditions and analyzing with- and without-project impacts.

Responsible Sacramento District Element:	
Engineering Division, Hydraulic Design and Water Management Sections	
Cost:	
Sponsor's In-Kind Contribution:	$5,000
Sacramento District:	$116,000
Current Total Estimated Cost:	**$121,000**

Engineering Design Analysis and Report; Civil Design

The Engineering Division of CESPK will be responsible for this task. The CESPK along with support from the sponsor will accomplish engineering analysis to prepare designs of alternatives considered and assemble this information into an Engineering Appendix to the PIR. CESPK will be responsible for preliminary engineering designs and analyses for the study effort. In addition, the Engineering Division will attend PDT meetings, and assist the Planning Division with the preparation of the draft and final PIR and EIS.

1. Technical Engineering: The Soils and Civil Design Sections will provide the Engineering Technical Managers (ETM) or Lead Designers. The ETMs will coordinate, help plan, and lead all Engineering Division activities, ensure that work performed by the PDT and sponsor is appropriate for the PIR, provide answers to questions regarding engineering aspects of the study, prepare responses to comments received during review of the draft PIR, and provide input to the PMP. This overall management task will be ongoing throughout the study and will be in accordance with ER 1110-2-1150, as amended by CECW-EP memorandum, 31 August 1999, subject: Engineering, Design, and Dam Safety Guidance. This also includes coordination with other technical elements of Engineering Division and with the sponsor in order to determine the location and configuration of the various structural features.

2. Designs: This subtask consists of preparing engineering designs by the PDT for alternatives considered.

- Topography and Bathymetry: Topographic and bathymetric surveys will be required for the various alternatives in order to prepare cross sections for developing preliminary designs. Existing topography and bathymetry will be used, to the extent possible, from DWR's North Delta Flood Control and Ecosystem Restoration Project.

- Preliminary Designs: Comparative studies, field investigations, design, and screening-level cost estimates will be in sufficient detail to substantiate the recommended plan and the estimate. The Engineering Appendix will discuss the selection of the project area and evaluation of alternative layouts, alignments, components, aesthetics, and relocation of facilities, and will describe the components and features, including the improvements required on lands to enable the proper disposal of dredged or excavated material. This work will entail preparing civil typical drawings or plates using data provided by the sponsor to the extent available and collected by other disciplines; developing digital terrain models for site layout of new levee templates and cross sections; providing site layouts for ecosystem restoration; computing quantities and identifying haul routes; construction scheduling; and identifying OMRR&R requirements and cost estimates. The Engineering Appendix will contain the results of studies and analysis performed by Hydrology, Hydraulic, Geotechnical, and Civil disciplines.
- Plans: Preliminary civil design typical drawings will include levee plans, interior grading plans, and the Dead Horse Island East Levee plans. Each drawing set will include existing topography and bathymetry (as appropriate), the proposed rehabilitation design on preliminary plan and profile sheets, and levee cross section sheets. Volumes of materials will be estimated from these drawings for use in preparing a 30-percent cost estimate for the levee rehabilitation. Any environmental mitigation designs as determined in the environmental analyses will be included in the design drawings. Each of the three drawing sets is described below.
- Levee Plans: This drawing set includes 62 drawings which will cover approximately 33,000 linear feet of levees (transmission tower protective levee, east and southwest levees, and landside levees) and the borrow area. The drawing set will include cover sheet, index sheet, one borrow site grading plan, two sheets of construction details, 25 plan and profile sheets and 32 cross-section sheets.
- Interior Grading Plans: Assuming 17,000 linear feet for the interior corridor channel, 17 interior grading plans will be prepared depicting plan and profile at every 1,000 feet.
- Dead Horse Island East Levee Plans: Based on the Dead Horse Island east levee length of 3,000 linear feet, this drawing set will include four plan and profile sheets and five cross section sheets.
- Civil Design will develop and describe the engineering requirements relating to site layout, the determination of lands, easements, right-of-ways, and borrow and disposal sites are necessary for the construction, operation, and maintenance of the alternatives. Civil Design will prepare preliminary design drawings depicting engineering requirements for use by Engineering and Real Estate in jointly determining land requirements. In addition, Civil Design will identify proposed relocations and the related land requirements. Relocation work will consist of data searches of records, private and public utility records, and site visits. Civil Design will assist in scheduling and diversion/dewatering schemes including over-winter protection planning.
- Civil Design will also be responsible for reviewing the ecosystem restoration areas designs in consultation with other PDT members and the sponsor using rough elevation plans and alignments developed by both Civil Design and Hydraulic Design Sections.

3. Project Delivery Team Participation and Support of the PIR and EIS: The Engineering Division and applicable PDT members shall insure that the designs obtained from the sponsor or external sources are used appropriately to assess impacts for the different alternatives. The Engineering Division shall assist and support the PDT by attending meetings, coordinating with the sponsor and DWR, and assisting in preparation of the PIR and EIS by providing interpretation of designs to set baseline conditions and analyzing with- and without-project impacts.

Responsible Sacramento District Element:	
Engineering Division, Civil Engineering Design Section	
Cost:	
Sponsor's In-Kind Contribution:	$15,000
Sacramento District:	$512,000
Current Total Estimated Cost:	**$527,000**

Landscape Architecture

The Engineering Division, Landscape Architectural Unit will be responsible for coordinating and developing landscape designs for three alternatives for the conceptual ecosystem design report. This report will address development of ecosystem habitats and erosion control grasses for levee slopes. The landscape architect will work closely with all PDT members and resource agencies to incorporate best management practices for the Delta ecosystem. The Unit will ensure the project is in compliance with ETL 1110-2-571 and review all completed preliminary work products.

This work comprises ecosystem restoration for the entire McCormack-Williamson Tract to riparian, shaded riverine aquatic, and wetland habitats, as appropriate. It also includes the selection of appropriate erosion control levee grasses, for the landside and waterside of levees, and a recommendation as to the proper application season and method. This work also assumes participation in meetings and the development of a report describing the design alternatives, selecting the plant species and quantities, and the restoration methods required to develop the habitats. The design report will be included with civil design documents in the Engineering Appendix. The landscape architect will prepare a working cost estimate for each alternative and provide the estimates to the Cost Engineering Branch for their use.

Responsible Sacramento District Element:	
Engineering Division, Landscape Architecture Unit	
Cost:	
Sacramento District:	$25,000
Current Total Estimated Cost:	**$25,000**

Geotechnical Studies and Report

The Engineering Division of CESPK will be responsible for assuring this task is completed according to Federal guidelines. The task includes data collection, analyses, reports,

meeting attendance, guidance, review of methodologies and report, approval of analyses, and summary reports conducted by CESPK. The geotechnical studies and report will be used for the PIR and evaluation of alternatives. Particular emphasis will be placed on the discovery of any detrimental subsurface elements that may make a particular alternative unattractive. The study work will include geotechnical explorations, analyses, and reports. The Functional Team Lead for geotechnical will be responsible for compiling all pertinent information for inclusion into the Engineering Appendix.

1. Geotechnical Analysis – This task includes development of baseline geology and soils data, review of existing geological information and existing field investigation information, concept designs for proposed work, and investigation of the ecosystem restoration areas. Particular information will come from data from the existing levee. This will also include the results of the geotechnical analyses of the proposed alternatives in the formulation plan (seepage, under-seepage, stability analyses). This information will come from the following:

- Review of existing geotechnical/geomorphological data provided by RD 2110 and DWR, review available geomorphologic data, and past history of levees during flood events.
- Analyses of existing conditions, and review previous geotechnical analyses as needed to assess the existing conditions of the levees and ecosystem restoration areas.
- Drilling and Laboratory Analyses:
    - Subsurface investigations to adequately characterize the alternatives will include cone penetration tests (CPTs) through the crests of the existing levees every 1,000 feet and at the toes of the existing levees every 2,500 feet, with correlating soil borings every 2,500 feet along the levee crests and every 5,000 feet along the levee toes, unless otherwise noted below. All soil borings will be collected by mud rotary drilling techniques. Laboratory analyses of retrieved samples will include shear strength, permeability, tests to identify parameters used to estimate permeability, and compaction, as well as other soil index properties. The proposed exploration plan will be coordinated with environmental specialists to meet NEPA and permitting requirements. Using these guidelines, CPTs and borings will be used to characterize the subsurface conditions of the following components of the proposed alternatives:
        - Borrow Site: Subsurface geotechnical investigations will be performed along and adjacent to the currently identified alignment of the interior corridor resulting from breach of the Mokelumne River. The potential borrow area is approximately 3,600 feet by 1,800 feet in size. This area will be explored using 14 exploration trenches advanced to a depth of 10 feet (minimum) or until soft organic deposits are encountered.
        - Transmission Tower Protective Levee: A total of 10 CPTs and 20 soil borings will be drilled for the Transmission Tower Protective Levee site. The CPTs will be conducted as follows: four along the proposed centerline of the levee, three along the landside toe, and three along the waterside toe. The soil borings will be collected as follows: seven to eight borings along the proposed centerline of the levee, six along the landside toe, and six along the waterside toe. In addition, four soil borings will be collected approximately 500 feet from the landside toe along the

proposed levee to analyze for potential underseepage. CPTs will be advanced adjacent to the soil borings to allow comparison of results. The CPTs and soil borings will be advanced to a depth of three times the proposed levee height and at least 10 feet into competent material underlying the soft organic deposits. For estimating purposes, borings and CPTs will be advanced to a depth of 50 feet.

- Weirs at East and Southwest Levees: A total of eight CPTs and five soil borings will be drilled and advanced adjacent to each other at every other boring location to allow a comparison of results at each of the weir locations as follows: five CPTs along the weir centerline, three CPTs along the landside toe, three CPTs along the waterside toe, three soil borings along the weir centerline, and two soil borings along the landside toe. The CPTs and soil borings through the centerline will be advanced to a depth of four times the existing levee height. Landside toe CPTs and borings will be advanced to a depth of three times the existing levee height. For either location, borings will be advanced at least 10 feet into competent material underlying the soft organic deposits. For estimating purposes, centerline borings are estimated to be 65-feet deep and the toe borings to be 50-feet deep. In addition to the CPTs and borings, waterside samples of rip rap will be taken with a backhoe at three locations along each weir to assess the character and thickness of the existing riprap and further assess the underlying levee fill for possible reuse in construction of the project.
- Levee Reinforcement for Dead Horse Island East Levee: A total of six CPTs and three soil borings will be drilled adjacent to one another to allow comparison of results. The CPTs and soil borings through the crest will be advanced to a depth of four times the levee height. The landside toe CPTs and boring will be advanced to a depth of three times the levee height. For either location, borings will be advanced at least 10 feet into competent material underlying the soft organic deposits. For estimating purposes, crest borings are estimated to be 65-feet deep and the toe borings to be 50-feet deep. In addition to the CPTs and borings, samples of rip rap will be taken by backhoe at three locations on the waterside slope to assess the character and thickness of the existing riprap and further assess the underlying levee fill for design of the waterside slope protection designs. A total of 10 test pits will be excavated along the levee crest.

  - Geotechnical laboratory analyses are required to adequately design and assess the proposed alternatives. Using existing data and newly-collected borings, geotechnical engineering parameters will be developed for slope stability, seepage, erosion, and settlement analyses, as appropriate for each of the proposed alternatives. All results from these analyses will be presented in the Engineering Appendix.

- A summary geotechnical report of the existing conditions summarizing all existing geotechnical and geomorphologic data, with the results of all geotechnical evaluation of the existing levee (including seepage, under-seepage, stability, erosion, and past history) and of the alternatives.

2. Geotechnical Reports – Geotechnical reports will be prepared by CESPK to document all information developed, analyses, and results as part of the final geotechnical studies for the existing conditions and for the proposed alternatives. CESPK will attend meetings, review, approve, and incorporate geotechnical information in a summary report to be used by the Environmental Planning Section in preparation of the EIS and included in the Engineering Basis of Design Appendix by CESPK and will include all pertinent plates and figures. Included in the reports will be:

- Summary of all existing and new field exploration laboratory test data;
- Design of the levee embankment of the proposed alternatives considering all geotechnical analyses;
- Basic requirements for the materials to be used in the construction of the levee embankment for the proposed alternatives;
- Characterization of any borrow materials to be used, including material types and construction requirements; and
- Geotechnical synopsis including the effects of the final alternatives.

3. Engineering Appendix: This task includes development of a draft and final Engineering Appendix to be attached to the PIR. Final deliverable products will be detailed in individual SOWs. The CESPK with assistance from the sponsor will develop the draft Engineering Appendix based on public, agency, and CESPD input. The final Engineering Appendix will be included as part of the final PIR. Included in the Engineering Appendix will be an estimate of the construction schedule. This will be developed for implementation of the recommended plan. The schedule will include the sequence of land acquisition, design, and construction operations, and will incorporate construction window constraints based on the ESA, California Endangered Species Act, and other requirements. The type of equipment used during construction, timing and duration of equipment use, duration of overall construction period, and the affected construction area will be estimated for use in evaluating environmental effects.

4. Technical Guidance Documents: The following guidance documents will be used in the geotechnical analyses:

- Geotechnical Levee Practice SOP EDG-03, dated 7July 2004;
- EM 1110-2-1913 Design and Construction of Levees (2000);
- WES TM 3-424 (1956);
- EM 1110-1-1804 Geotechnical Investigation (2001);
- EM 1110-1-1906 Soil Sampling;
- ER 1110-1-8100 Laboratory Investigations and Testing (1997);
- ETL 1110-2-569 – Engineering and Design – Design Guidance for Levee Under seepage (2005); and
- PL 84-99 Delta Specific Standard.

Responsible Sacramento District Element:	
Engineering Division, Geotechnical Branch	
Cost:	
Sacramento District:	$446,000
Current Total Estimated Cost:	**$446,000**

Geology Studies and Report

The Engineering Division of CESPK will review data from available previous geotechnical investigations, including the sponsor's geotechnical reports, if any, to characterize surface and subsurface geology and geomorphology of the study area in a geological report.

1. Geology and Geomorphology Report: A geology and geomorphology report will be prepared describing all pertinent information from the geologic and geomorphologic review including, but not limited to:

- geologic maps of the investigation site,
- geomorphology maps of the area,
- groundwater levels noted during drilling, and
- all unusual occurrences noted during the investigation.

2. Technical Guidance Documents: The following guidance documents will be used in the subsurface investigation and characterization of the geology of the study area:

- Geotechnical Levee Practice SOP EDG-03, dated 7July 2004,
- EM 1110-2-1913 Design and Construction of Levees (2000),
- EM 1110-1-1804 Geotechnical Investigation (2001),
- EM 1110-1-1906 Soil Sampling,
- ASTM D-1587 Standard Practices for Thin-Walled Tube Sampling of Soils (1983),
- ASTM D-2487 Standard Practices for Classification of Soils for Engineering Purposes (Unified Soil Classification System) (2000), and
- ASTM D-2488 Standard Practices for Description and Identification of Soils (Visual-Manual Procedures) (2000).

Responsible Sacramento District Element:	
Engineering Division, Geology Section	
Cost:	
Sacramento District:	$30,000
Current Total Estimated Cost:	**$30,000**

Real Estate

The Real Estate Division of CESPK will be responsible for completing Real Estate tasks, with input from the RD 2110 and TNC, who owns the McCormack-Williamson Tract. Work includes coordination, preparation of the Real Estate Supplement, review and revision of report documents, preparation of gross appraisal, preparation of real estate map, physical taking analysis, preliminary attorney's opinion of compensability, rights of entry, cost estimates, real estate input to PMP, and technical input.

1. Real Estate Coordination and Evaluations: This subtask includes all the coordination and evaluations required to complete Real Estate effort for the feasibility study. Major work efforts include:

- **Real Estate Coordination:** Includes, but is not limited to, CESPK participation in PDT meetings, negotiation of work requirements, coordination with other offices on study data needed for Real Estate's major study products, and monitoring of progress and findings associated with Real Estate study products.
- **Baseline Real Estate Cost Estimate:** This work includes accounting for the plan's total estimated real estate cost for each alternative during plan formulation in Code of Accounts format as required by EC 1110-2-528 under Feature Codes 01, Lands and Damages. This estimate of total real estate cost should include estimated costs for all Federal and non-Federal sponsor activities necessary for completion of the plan.
- **Gross Appraisal:** This work will include preparation of a detailed estimate of all real estate costs associated with acquisition of the real property requirements for each alternative during plan formulation (see ER 405-1-12, Chapter 12, Section III, Appraisals, paragraph 12-12b, and Real Estate Policy Guidance Letter Number 3, Guidance for Preparation of Gross Appraisals).
- **Preliminary Real Estate Acquisition Maps Preparation:** Determine ownership and acreage for each alternative during plan formulation. Prepare real estate preliminary take line drawings.
- **Physical Takings Analysis:** Analytical task to evaluate if the alternatives hydraulically affect property by taking or diminishing property or rights for the public's use by modifying the frequency, depth, or duration of water upon the property.
- **Preliminary Attorney's Opinion of Compensability:** An investigation and preliminary attorney's determination will be made, if owners of facilities or utilities affected by the plan have a vested interest and compensable interest in the property, with regard to the real estate taking. If so, the obligation or liability of the Federal Government is the cost of providing substitute facilities or utilities, if necessary, for existing publicly owned roads and utilities, as well as existing privately owned railroads and utilities.
- **Rights of Entry:** CESPK will coordinate requests and work with the sponsor to obtain rights-of-entry for the survey, HTRW, cultural resources, environmental, and geotechnical exploration work required. Rights-of-entry must be obtained before testing can be done on privately owned property.

2. Report Preparation: This subtask includes completion of real estate documentation for the PIR. Major work efforts include:

- **Preparation of Real Estate Plan:** This work includes preparation of the Real Estate Plan, which is an overall plan describing the minimum real estate requirements (see ER 405-1-12, Chapter 12).
- **Review and Revision of Report Documents:** Includes all CESPK activities involved in reviewing the draft and final PIR, and responding to CESPD comments.
- **Prepare Real Estate Take Package to the Non-Federal Sponsor:** Prepare and provide the Real Estate Take Letter accompanied with cadastral mappings and tract register to describe specific real estate that will need to be acquired for the project. This will include the determination as to the type of estate or easements that the non-Federal sponsor will need to procure prior to construction.

Responsible Sacramento District Element:	
Real Estate Division	
Cost:	
Sponsor's In-Kind Contribution:	$10,000
Sacramento District:	$75,000
Current Total Estimated Cost:	**$85,000**

HTRW Assessment and Report

The Engineering Division of CESPK will be responsible for this task. The purpose of this task is to assess issues or potential concerns associated with hazardous, toxic, radiological waste (HTRW) that may be located in the study areas boundaries or may affect or be affected by alternatives considered in the MWTFS. The DWR completed an agency database search for recorded HTRW in the project area for the North Delta Flood Control and Ecosystem Restoration Project. The analysis will be completed in accordance with HTRW Guidance for Civil Works Projects, ER 1165-2-132, 26 June 1992 with the scope and limitation of the American Society for Testing and Materials Practice (ASTM) E-1527-05.

1. HTRW Research: The primary work effort for this task includes the following:

- **Review of Agency Record Search Report:** CESPK will use the agency database record search of HTRW in the study area conducted by DWR. The record search report will be attached to the draft and final reports as an appendix. Review will include any available historical aerial photos and historical topographic maps, and an environmental records search from a private vendor for the applicable ASTM E-1527-05 search distances.
- **Site Reconnaissance and Site Inspection:** After review of the regulatory agencies database, the study area will be visited for site inspection, where accessible. Any potential HTRW sites will be photographed, and spatial horizontal data of those areas will be collected using North American Datum (NAD) 83, State Plane III, in feet. Any vertical data collected shall use the NAVD88 datum.
- **Preparation of White Paper:** The Engineering Division will prepare a White Paper that will document the project conditions relative to water quality, soil and sediment quality for consultation with resource agencies and the Central Valley Regional

Water Quality Board (CVRWQCB). The Engineering Division will meet with the CVRWQCB and present the results of the White Paper.

- **Sampling and Analysis Plan for Soil Borings:** The Engineering Division will prepare a Sampling and Analysis Plan (SAP) for the collection, preparation, and laboratory testing of soil samples taken to establish baseline soil conditions in the project area. The SAP would be written to support conclusions reached in the White Paper above. The SAP will be prepared using appropriate sections from the USACE guidance on SAP preparation and the UFP-QAPP preparation guidance. CESPK will be responsible for the collection, preparation, and laboratory analyses of the soil samples according to the SAP. The laboratory analyses will test for constituents of concern according to the SAP. Testing will be based on DoD and State standards and requirements. The Engineering Division will review the analytical results for any potential HTRW issues.

2. HTRW Reports: On the basis of the above record search, site reconnaissance, draft and final documentation will be completed describing significant findings in the regulatory agencies database in a Phase 1 Environmental Site Assessment, including sites visited or surveyed, and areas of concern. A final report will be prepared based on comments on the draft document.

3. Project Delivery Team Participation and Support of the PIR and EIS: The Engineering Division and applicable PDT members shall insure that the HTRW data and reports are used appropriately to assess impacts for the different alternatives. The Engineering Division shall assist and support the PDT by attending meetings, coordinating with the sponsor and DWR, and assisting in preparation of the draft and final PIR and EIS by providing interpretation of HTRW findings to set baseline conditions and analyzing with- and without-project impacts.

Responsible Sacramento District Element:	
Engineering Division, Environmental Engineering Branch	
Cost:	
Sacramento District:	$70,000
Current Total Estimated Cost[1,2]:	**$70,000**

[1] Assumes a no field work or sampling and analysis will be performed
[2] Assumes a single research and database evaluation

Economic Impact Analysis and Report

The Planning Division of CESPK will be responsible for this task. The authorizing federal legislation for the CALFED Levee Stability Program does not stipulate a need for full economic feasibility analysis. However, a life cycle cost effectiveness analysis and report will be the primary focus of the economic analysis.

The goal of the life cycle cost analysis is to compare the cost of construction and associated annual operation and maintenance throughout the economic life of the activity and to choose the least costly one. At present it is a way to account for the effects of the differing alternatives that may be considered as part of the CALFED Levee Stability Program.

Although the cost effectiveness is the primary focus, it is also necessary to provide information with the economic analysis on a synoptic summary of the assets and resources on the Island, and their value to the Delta and the State of California. These qualitative remarks are expected to be available for the entire evaluation team and the decision-maker to consider as part of the analysis.

1. Economic Impact Report: Based on available information, the socio-economic characteristics of the study area will be discussed, including but not limited to project location, population; description of economic assets and other valuable resources such as roads; bridges; oil and gas pipelines; railroads, pumping stations; treatment plants; municipal utilities; residential commercial, industrial and public buildings—as captured in the Delta GIS database for the DRMS; agricultural lands; the regional importance of the project; and, history of previous flooding.

2. Economic Project Cost Effectiveness Analysis: Based on the alternatives formulated, CESPK will identify at least two alternative plans for cost effectiveness comparison. The objective of the proposed actions under the CALFED program is to provide a base level of protection, also known as the ‘‘Public Law 84–99 Standard,’’ in order to manage periodic flooding and minimize associated adverse effects and costs. Accordingly, work conducted by the USACE will be required to meet all applicable Federal regulations and due diligence requirements. These shall include the following**:** Section 401 and Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and National Pollution and Discharge Elimination System Program. These conditions will be adhered to throughout the economic analysis conducted herein.

The Planning Division shall identify the preferred alternative using a cost-effectiveness test. Project justification will be determined based on demonstration that the selected plan is the most cost effective and justified to achieve the desired level of outputs.

3. Project Delivery Team Participation and Support of the PIR and EIS: The Planning Division shall assist and support the PDT by attending meetings, coordinating with the sponsor, and assisting in preparation of the draft and final PIR and EIS to set baseline conditions and analyzing with- and without-project impacts.

Analytical Assumptions

1. Real property will continue to be repaired to pre-flood conditions subsequent to each flood event.

2. The project’s first costs will be included in the analysis along with the annual operation and maintenance costs for an assumed project life of 50 years.

3. The cost effectiveness analysis will be conducted using the current Federal Planning discount rate. The current rate is 4 3/8 percent.

4. All values will be based on constant dollar basis for comparative purposes.

The remaining physical life for all structures in the floodplain is 50 years. Therefore there will be no salvage analysis done on remaining structures.

Responsible Sacramento District Element:	
Planning Division, Economic Risk Analysis Section	
Cost:	
Sacramento District:	$12,000
Current Total Estimated Cost:	**$12,000**

Cost Estimates and Report

The Engineering Division of CESPK will be responsible for this task. The Corps' Engineering Support Branch (Cost Engineering Section) will prepare preliminary costs estimates for alternatives and feasibility-level baseline cost estimates of the selected plan. These estimates will be the total cost (Federal and non-Federal) of implementing the plan. Detailed total project cost and annual costs for the recommended alternative will be developed using Microsoft Excel. Construction costs will be developed using MII (Micro-Computer Aided Cost Estimate System (M-CACES), Second Generation). Detailed task descriptions are provided below.

1. Alternatives Costs: Using information from this study, other projects, and investigations in the area, the Corps will develop preliminary cost estimates (code of accounts format) for all features for alternatives considered.

2. Draft Cost Estimate: CESPK will develop baseline construction cost estimates for the selected alternatives using MII software. Summary reports (Excel spreadsheets) will be developed to identify total project costs (Federal and non-Federal) for implementing the recommended alternative, including construction costs, Lands, Easements, Right-of-ways, Relocations, and Disposal Sites (LERRDS), mitigation, engineering and design (including landscape design), and construction management. The detailed first and annual cost estimates will include OMRR&R, interest during construction, etc. These estimates will be developed for the recommended alternative in accordance with Unified Facilities Criteria (UFC) 3-700-02A, "Construction Cost Estimates", 01 March 2005, and ER 1110-2-1302, "Civil Works Cost Engineering", 15 September 2008. The OMRR&R will be consistent with ER 1110-2-1150, "Engineering and Design for Civil Works Projects", 31 August 1999. A narrative basis of the estimate will be prepared and included in the draft Engineering Appendix to the draft PIR, along with the draft summary of total project cost and annual costs and the draft MII construction cost estimate. Costs for the project are not expected to require cost risk analysis at this time, however, if costs for the selected alternative reach up to $40 Million, then cost risk analysis will be required and performed using Crystal Ball software.

3. Final M-CACES Cost Estimate: CESPK will finalize the cost estimates based on comments received on the draft PIR.

Responsible Sacramento District Element:	
Engineering Division, Cost Engineering Branch	
Cost:	
Sacramento District:	$32,000
Current Total Estimated Cost:	**$32,000**

Sponsor's Technical Review

The non-Federal sponsor will conduct its own reviews at each of the major study milestones primarily to ensure that technical errors during the early phases are not carried forward into later phases of analysis. The sponsor's review will be conducted for the AFB, draft and final PIR and EA/IS documents. The sponsor's review comments will be forwarded to the planning technical lead and Corps Project Manager for incorporation or rebuttal.

Responsible Element:	
Sponsor's Technical Review Team	
Cost:	
Sponsor's In-Kind Contribution:	$60,000
Current Total Estimated Cost:	**$60,000**

Value Engineering

The goal of VE during the MWTFS is to ensure that the widest range of feasible and cost efficient measures from an engineering standpoint are considered and that alternatives formulated from those measures are not limited to those that first came to mind at the initiation of the study. The VE officer will facilitate the value engineering study, which will take place prior to the AFB conference. The VE officer will identify known technical and policy issues and recommend actions to resolve the issues. The results of the VE study will be presented in the draft PIR and integrated into the discussion of the formulation of alternatives.

Responsible Sacramento District Element:	
Value Engineering Team (Corps)	
Cost:	
Sacramento District:	$40,000
Current Total Estimated Cost:	**$40,000**

CALFED LSP Program Costs

Specific Program Management tasks include management and oversight, as well as the preparation of the required Coordination Act Reports (CARs) for projects in the program.

1. Program Management

CALFED LSP benefits all participating non-Federal sponsors. Program Management activities include ongoing correspondence with CESPD on policy issues, preparation of fiscal year budget requests and reports, reporting to CESPD and Headquarters on the program, preparation and update of the Report to Congress, coordination with resources agencies, and coordination with DWR and other State agencies funding local reclamation districts. Program management of CALFED LSP is the responsibility of CESPK.

2. Fish and Wildlife Service Coordination Act Report

The Planning Division of CESPK will be responsible for oversight of this task, which is to be performed by the USFWS and NMFS. CESPK will write SOWs and transfer funds to the USFWS and NMFS for review of biological surveys completed for DWR's permitting efforts, a Planning Aid Letter, and draft and final CARs. The Corps' effort will also include monitoring USFWS/NMFS work and providing USFWS/NMFS with required information such as description of alternatives and maps of affected area.

The USFWS/NMFS effort will include review of existing environmental data, evaluation of the environmental resources in the study area using HEP analysis , review of DWR's Biological Assessment, Section 404 documents, and Standardized Assessment Methodology (SAM) analysis for use in the MWTFS. The USFWS/NMFS will review alternatives, assess the effect of alternatives on the environmental values of the study area, and help to identify restoration and mitigation measures. The USFWS/NMFS will provide guidance and recommendations concerning the formulation of flood risk management alternatives. The USFWS will prepare draft and final CARs documenting their findings. The draft and final CAR will be included as an appendix to the EIS.

Responsible Sacramento District Element:	
Programs and Project Management Division, Civil Works	
Cost	
Sacramento District:	$55,000
Current Total Estimated Cost:	**$55,000**

Agency Technical Review

Funds for this task would be required to support PDT and ATR teams during the ATR process. See Appendix C for a detailed description of ATR tasks.

Responsible Sacramento District Element:	
Programs and Project Management Division, Civil Works	
Cost	
Sacramento District:	$25,000
Current Total Estimated Cost:	**$25,000**

Independent External Peer Review

Funds for this task would be required to support PDT and IEPR teams during the IEPR process, including reporting and contracting. The cost of conducting and reporting for the IEPR is cost shared between the Corps and Sponsor, while the Corps is wholly responsible for the IEPR contract. See Appendix C for a detailed description of IEPR tasks.

Responsible Sacramento District Element:		
	Programs and Project Management Division, Civil Works	
Cost		
	Conducting and Reporting of IEPR:	$45,000
	IEPR Contract:	$300,000
	Current Total Estimated Cost:	**$345,000**

Contingency

A 10% contingency has been added to the total study cost.

CHAPTER 6. STUDY MILESTONES AND SCHEDULE

DESCRIPTION OF MILESTONES

A system of milestones has been established to help monitor and manage study completion for projects under the CALFED Levee Stability Program according to the Headquarters Implementation Guidance for the Water Resources Development Act of 2007 – Section 3015 (WRDA 2007). Following is a highlight of each milestone for the MWTFS.

FCSA Signed – Initiate Feasibility Study (Similar to F1)

The PIR will be initiated by the signing of the FCSA. This milestone marks the beginning of the feasibility phase.

Alternative Formulation Briefing (AFB) (Similar to F4a)

The purpose of the AFB is to review the proposed plan and discuss policy issues, leading to early CESPD level acceptance of proposed recommendations and resolution of the issues. CESPK will present the alternative formulation and identify the tentatively selected plan. Representatives from CESPD, CESPK, and sponsor will attend the AFB. Pre-meeting documentation for AFB attendees will be made available at least 21 calendar days prior to the meeting. CESPD Planning Chief will chair the meeting. A final AFB guidance memorandum will be signed by CESPD within 15 working days of the AFB.

Draft PIR to CESPD, U.S. Environmental Protection Agency (EPA), & Public (Similar to F5)

Based on satisfactory completion of responses to the AFB guidance memorandum, the draft PIR will be forwarded to CESPD concurrent with its release for public review (45-day field level coordination).

Public Review/Meeting on Draft PIR and EIS (Similar to F6)

CESPK will present results of the draft PIR and EIS to the public and receive comments during the 45-day public review period.

Final Report to Division (Similar to F8)

CESPK will submit the final Implementation Report to CESPD in accordance with the Headquarters Implementation Guidance for WRDA 2007 and guidance in ER 1105-2-100.

STUDY SCHEDULE

The proposed schedule for the MWTFS is included in Appendix B. The schedule shows all milestones and the associated tasks, which must occur between each milestone. The estimated costs and schedule are subject to change.

This page left intentionally blank

CHAPTER 7. DISTRICT QUALITY CONTROL PLAN

DISTRICT QUALITY CONTROL (DQC) PLAN OBJECTIVES

The primary objective of this quality control plan is to ensure that the accomplishment and products of the MWTFS are of high quality. This will be done by establishing the appropriate level of evaluation of technical products and processes to ensure that they meet customer requirements and comply with applicable laws, regulations, and sound technical practices of the disciplines involved.

CESPK Project Manager is responsible for ensuring that ATR of the PIR, EIS, and related materials are resourced and executed consistent with the current CESPD and CESPK Quality Management Plans and associated technical review implementation guidance. CESPD will provide quality assurance, facilitate coordination with other districts to provide an ATR Team (ATRT) Leader and other members for inter-district review, and provide technical and planning management support to CESPK, as needed, in resolving major policy and technical issues.

GUIDELINES FOR TECHNICAL REVIEW

Products (identified in a paragraph below) will be reviewed for compliance with appropriate public laws; engineering regulations, circulars, and manuals; planning and policy guidance; and standard engineering and scientific practices. The guidelines for independent technical review are set forth in CESPD-R-1110-1-8, "South Pacific Division Quality Management Plan," September 2004, and in the corresponding "Sacramento District Quality Management Plan," March 2004.

LEVEL OF DETAIL OF REVIEW

Study products will be reviewed at a "feasibility level of detail" (consistent with the definition presented in Chapter 4 of this PMP) for:

- Compliance with established policy and other appropriate guidance;
- Adequacy of the scope of the document;
- Appropriateness of all planning, engineering, design, and environmental assumptions and methods, including development of without-project assumptions;
- Appropriateness of data used, including level of detail;
- Appropriateness of alternatives evaluated (completeness, effectiveness, efficiency, and acceptability);
- Consistency;
- Accuracy;
- Comprehensiveness; and
- Reasonableness of results.

PRODUCTS FOR REVIEW

All of the products listed in the detailed SOWs in Chapter 5 will be subject to ATR. As a part of ATR, seamless single discipline review will be accomplished and documented prior to the release of materials to other members of the study team or integrated into the overall study. PDT members and their respective Section Chiefs will be responsible for accuracy of the documentation and computations through District Quality Control (DQC), design checks and other internal procedures prior to the ATR.

ATR will occur prior to major decision points in the planning process at the CESPD milestones so that the technical results can be relied on in setting the direction for further study. These products will include documentation for the CESPD mandatory milestone conference (F4A) for the CALFED Levee Stability Program and the draft and final reports. These products will be essentially complete before ATR is undertaken. Since this quality control will have occurred prior to each milestone conference, the conference will address critical outstanding issues and set the direction for the next step of the study since a firm technical basis for making decisions will have already been established. In general, the ATR will be initiated at least 4 weeks prior to sending a complete and certified Pre-Conference Document and Decision Documents (draft and final PIR and EIS).

For products that are developed under contract, the contractor will be responsible for quality control through an independent technical review. Quality assurance of the contractor's quality control will be the responsibility of the District and the ATRT. The ATRT will review the following documents:

- PMP and update(s),
- Pre-AFB Document (F4A Milestone),
- Draft PIR and EIS (F5 Milestone), and
- Final PIR and EIS (F8 Milestone).

ATRT and PDT members will review all products provided by the sponsor. Appropriate ATRT members will also review the following study products prior to their incorporation into the overall study (seamless review):

- Plan Formulation;
- Hydrology and Hydraulic Design;
- Engineering Design;
- EIS;
- HTRW Report;
- Geotechnical/Geologic Design;
- Design Quantities, Figures, and Plates;
- VE Analysis;
- Cost Estimates;
- Economic Analysis;
- Risk Analysis; and
- Real Estate Assessment.

REVIEW PLAN

As required by EC 1165-2-209, a Review Plan has been prepared for the MWTFS and is documented in this PMP as **Appendix F**. The Review Plan addresses this DQC, ATR, and IEPR by a qualified team from outside the district and led from outside the Major Subordinate Command (MSC), and model certification requirements. Consistent with all CALFED Levee Stability Program Programmatic Review Plan, there will be an IEPR for the MWTFS.

COST ESTIMATE FOR QUALITY MANAGEMENT

The costs for conducting DQC are included in the individual SOWs that are included in Chapter 5. District quality management activities of Branch and Division Chiefs are included in Supervision and Administration. The total cost for ATR is approximately **$25,000**, and the total cost of IEPR is approximately **$300,000**. Seamless review occurs throughout the study process, as required. Specific review efforts will also occur associated with the AFB, the draft report, and the final report.

KNOWN POLICY QUESTIONS

There are no known policy issues that need to be addressed.

MAJOR TECHNICAL ISSUES

There are no known major technical issues that need to be addressed.

PMP QUALITY CERTIFICATION

The Chief of Planning Division has certified that (1) an independent technical review process for this PMP has been completed, (2) all issues have been addressed, (3) the streamlining initiatives proposed in this PMP will result in a technically adequate product, and (4) appropriate quality control plan requirements have been adequately incorporated into this PMP. The signed certification is included as **Appendix G**.

FEASIBILITY PHASE CERTIFICATION

The documentation of the ATR and IEPR will be included with the submission of the decision documents to CESPD. Such documentation of the ATR and IEPR will be accompanied by a certification indicating that the ATR and IEPR process has been completed and that all technical issues have been resolved. The certification requirement applies to all documentation that will be forwarded to CESPD for review or approval. The Chief of Planning Division will certify the draft PIR. The District Commander will certify the final PIR, which includes the signed recommendation of the District Commander. This certification will follow the example that is included as Appendix H of the CESPD Quality Management Plan and will be signed by the Chief of Planning Division and the CESPK District Commander.

The ATR and IEPR process will be coordinated with the Corps' National Planning Center of Expertise for Flood Risk Management and Center of Expertise for Ecosystem Restoration.

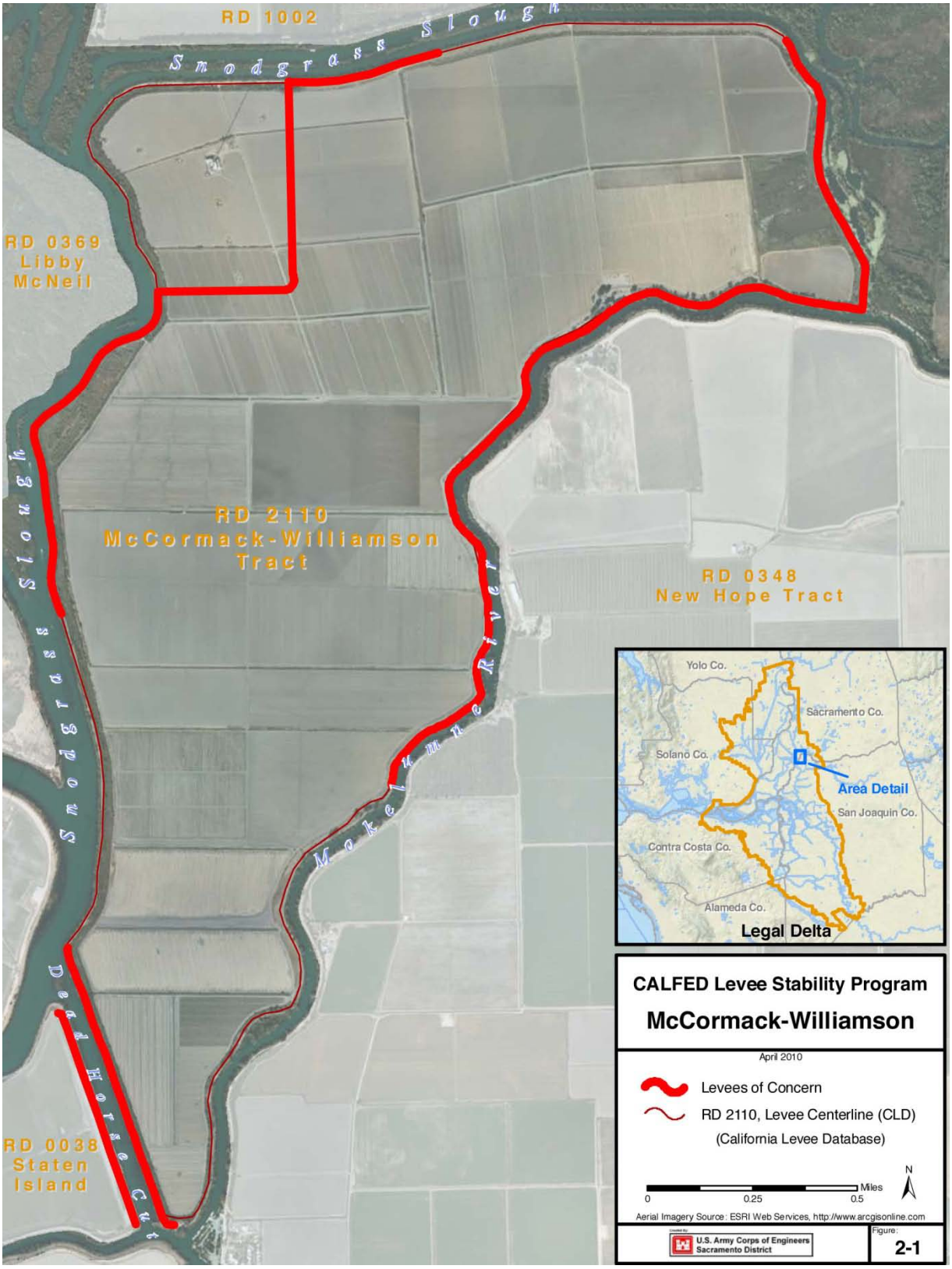
This page left intentionally blank

APPENDIX A

Study Location Map

This page intentionally left blank.

Figure 1. Study Location Map



This page intentionally left blank.

APPENDIX B

Study Schedule

This page intentionally left blank.

INSERT STUDY SCHEDULE

APPENDIX C

Review Plan

This page intentionally left blank.

APPENDIX D

Study Communication Plan

This page intentionally left blank.

CALFED Levee Stability Program
McCormack-Williamson Tract Feasibility Study
Study Communication Plan

PURPOSE:

This Study Communication Plan describes the basic elements for the McCormack-Williamson Tract Feasibility Study (MWTFS), which is one of many studies under the CALFED Levee Stability Program. The USACE Project Management Business Process directs that all projects, events, and issues of significant public interest have a communication plan. The goal is to provide accurate, timely, and consistent information to the public, stakeholders, and interested members of the USACE team. The Communication Plan consists of five parts:

(1) Background
(2) Project Goals/Objectives
(3) Research
(4) Rollout Plan
(5) Lessons Learned/Next Steps

I. BACKGROUND

In recognition of the human and environmental importance of the Sacramento-San Joaquin Delta System (Delta) and the serious threat of levee failures with disastrous and wide-spread consequences, Congress passed the Water Supply, Reliability and Environmental Improvement Act, Public Law 108-361 (CALFED Bay-Delta Authorization Act of 2004). This Act provided for USACE participation in the CALFED Program by authorizing the Secretary of the Army to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality objectives. In May 2006, the USACE submitted the "CALFED Levee Stability Program Report to Congress", which satisfied the CALFED Bay-Delta Authorization Act requirement to submit a report to Congress that describes the levee stability reconstruction projects and priorities that were to be carried out under the program within the Delta. This report was prepared with non-Federal input and support and identified 54 projects totaling more than $1 billion in estimated costs. One of the submissions to the USACE for consideration under this program was the proposed McCormack-Williamson Tract project.

The McCormack-Williamson Tract levees are constrained in height by a legal agreement and as a result the tract has flooding during high water events, particularly along the eastern boundary, due to a phenomenon known as a flood surge effect. The inflow of water during these events can create scour holes, result in damage to the levees, and if sufficient water accumulates, generate a downstream flood surge when other portions of the levees (typically along the western and southern boundaries) are overtopped or fail. This flood surge poses a risk to lives, property, and infrastructure in adjacent areas, including Walnut Grove, Dead Horse Island, Staten Island and the marina at New Hope Landing. During flood events, unmoored boats can become lodged against the New Hope Bridge, compounding channel constriction. The channel constriction can cause water surface elevations to rise and back up water flow, which could create unstable conditions in adjacent areas. This can result in substantial property damage and threaten human safety, both in the immediate area and on adjacent islands. Uncontrolled flooding at McCormack-Williamson Tract could pose a threat to public facilities and

infrastructure in the North Delta area, including Interstate 5, the Union Pacific Railroad line, and the Rio Cosumnes Correctional Center.

In addition, portions of the levees surrounding the tract are unstable and require improvement to avoid failure that could result in flooding of the tract and/or damage to the adjacent properties. Levee stability issues include landside levee slopes that are over-steepened, with some slopes steeper than 1H:1V. The over-steepened slopes are the result of damage that occurred during a flood in 1997, when the island was inundated. Dense vegetation exists on a large portion of the perimeter levee system, both on the landside and waterside. In many areas, the vegetation is dense enough that the over-steepened conditions are not visible. The levees were originally constructed using material that is predominantly sand. The crown has very little aggregate base on the surface, making the levees difficult to navigate during wet conditions. The crown width generally varies between 15 and 20 feet. In many areas, vegetation restricts access, with enough width to accommodate only a single vehicle. The waterside slopes are largely unarmored. Broken concrete slabs and riprap have been placed in various areas.

The Delta currently supports an estimated 750 species of plant and animal species that are, in part, supported by Delta levees that maintain flows and water quality. Development of the Delta over the past 150 years, however, has resulted in a substantial reduction in wetlands, intertidal marsh, and shaded riverine aquatic (SRA) habitats, which in turn has resulted in the formal designation of numerous species as endangered or threatened. Typical measures used to repair or stabilize levees often lead to negative impacts to critical habitat for these Delta species. For example, rocking in-water levee slopes has been associated with loss of critical habitat for endangered species of fish (e.g., salmonids).

Previous work by RD 2110 has addressed some of the levee stability concerns, but longer term solutions are needed. Previous work included reshaping the levees from Stations 50+00 to Station 140+00 and from Station 355+00 to Station 425+00 to create habitat friendly levees by flattening the landside levee slope, creating a habitat bench, and planting vegetation (in three elevation-based “zones”) to provide protection against wind waves and high water levels when the Tract is flooded in the future. Work proposed in conjunction with the MWTFS would be consistent with this recently-completed work.

With this study effort, there is an opportunity to reduce the risk to life and property from occasional flooding or catastrophic breaching of the McCormack-Williamson Tract levee and to provide ecosystem restoration. One alternative for consideration is to lower the height of the eastern levees, which would increase flooding of the tract (and reduce upstream flood risks), reduce the height of the southwestern levee (which would reduce the potential for a flood surge when those levees are overtopped), increase the height of levees on adjacent islands (such as Staten Island, to reduce flood risk), and install a new levee to protect the transmission tower. This alternative would create tidal, intertidal, and shaded riverine habitat, providing ecosystem restoration benefits. This proposed McCormack-Williamson Tract project represents an opportunity to achieve multiple CALFED LSP purposes that complement one another and present a more balanced solution to levee stabilization along the McCormack-Williamson Tract.

II. OBJECTIVES

The objectives of the McCormack-Williamson Tract Feasibility Study are:

- reduce upstream flood stages on the Mokelumne River,
- reduce flood surges through the McCormack-Williamson Tract,
- reduce flood risk to adjacent areas, populations and infrastructure in the study area,
- reduce levee operations and maintenance costs,
- rehabilitate and upgrade unstable levee sections on Dead Horse Island, Staten Island, and Tyler Island, and
- increase fish and wildlife habitat and ecosystem value in the study area.

The USACE has assembled a Project Delivery Team (PDT) for this study effort that includes representatives from the Corps, RD 2110, DWR, and several Federal and state agencies. A complete list of PDT members is provided in Table 3-1 of Chapter 3 of the MWTFS Project Management Plan (PMP). The Corps, South Pacific Division will be involved during the plan formulation efforts of the study and review of the Project Implementation Report (PIR) and Environmental Impact Statement (EIS), and will be assisting the Sacramento District with resolving policy issues associated with implementing the Levee Stability Program as they relate to this specific project. USACE Headquarters will also participate in MWTFS during the Alternatives Formulation Briefing, review of the Draft PIR, and the development of the Feasibility Cost Sharing Agreement (FCSA) and Project Partnership Agreement (PPA). RD 2110 will participate in PDT meetings and by provide engineering and design support through plan formulation.

III. RESEARCH

The proposed alternatives for the MWTFS include:

1. **No Action Alternative.** This alternative would result in the continued uncontrolled flood surges, property damage, erosion and seepage of levees, and require regular repair work in the study area. This alternative would result in a higher risk of levee failure and flood damage in the future due to continued degradation of levees in the study area. There are no identifiable benefits to this alternative.

2. **Alternative 2 (DWR Alternative 1-B)**. This alternative would consist of reducing the height of the eastern and southwestern levees, reslope approximately 18,000 feet of existing landside levee to create a habitat bench, enhancement of landside levee habitat, reinforcement of 3,800 feet of the Dead Horse Island east levee with riprap blanket on waterside slope, construction of protective levee on the landside of the transmission tower on the northwest corner of the tract, demolition of a farm residence and associated farm buildings, raise 40,000 feet of the Staten Island levee up to 3 inches along the southern stretch of the North Fork of the Mokelumne River, and modify the landform and restore agricultural land to habitat. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern degraded levee at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. The risks of this alternative are adverse

environmental consequences, including the loss of sensitive habitats (e.g., elderberry bushes), potential for fish strandings, and effects on threatened and endangered species (e.g., from in-water construction work). The study will address ways to reduce the potential for fish stranding and loss of habitat for special status species, especially that of the Valley elderberry longhorn beetle. The benefits of this alternative would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, and reduced Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) requirements.

3. **Alternative 3 (DWR Alternative 1-C)**. This alternative would include all of the elements of Alternative 2 and the construction of a cross-levee on the lower third of the McCormack-Williamson Tract to promote sedimentation as part of a subsidence reversal demonstration project. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern degraded levee at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. This alternative would result in adverse environmental impacts generally similar to those identified in Alternative 1. The study will address ways to reduce the potential for fish stranding and loss of habitat for special status species, especially that of the Valley elderberry longhorn beetle. Benefits would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, reversal of land subsidence, and reduced OMRR&R requirements.

4. **Alternative 4 (DWR Alternative 1-A)**. This alternative would include all of the elements of Alternative 2, with the addition of breaching of the Mokelumne River levee in the northeast portion of the Tract, and the construction of an interior channel (from the location of the levee breach) and associated ecosystem restoration features to allow for tidal influences in the northern portion of the island and reduce fish strandings in the southern portion of the Tract. This alternative would result in controlled flooding of the island during flood flows that exceed the elevation of the degraded eastern levee on the Mokelumne River and release flood flows at the southwestern degraded levee, which would be degraded to match the elevation of the island floor, at a more controlled rate, thereby reducing the current effects of flood surges on neighboring islands. This alternative would result in adverse environmental impacts that would be less than those identified in Alternative 1, as the potential for fish strandings would be reduced. Benefits would include increased levee stability, reduced flood risk on neighboring islands, restoration of tidal, intertidal, and shaded riverine habitat, reversal of land subsidence, and reduced OMRR&R requirements.

Both the Corps and RD 2110 will finalize and approve the Study Communication Plan, and will share duties during its implementation. With the communication plan's limited focus on external public outreach and involvement to the review of the Draft PIR and Draft EIS, USACE approval will reside with the District Engineer, Sacramento District.

Documents used in the preparation of the Communication Plan include:

- Water Supply, Reliability, and Environmental Improvement Act, as amended by WRDA 2007;
- Headquarters Implementation Guidance for WRDA 2007 – 3015 CALFED Levee Stability Program (2008);

- CALFED Levee Stability Program Report to Congress on the U.S. Army Corps of Engineers Strategy for Action (CESPK, 2006); and
- CALFED Bay-Delta Record of Decision (2000).

IV. ROLLOUT PLAN

Target Audiences: Stakeholders for the MWTFS include RD 2110, TNC which is the property owner of McCormack-Williamson Tract, upstream and downstream reclamation districts, marinas, adjacent landowners, residents, tribes, farmers, and businesses, utility companies, DWR, and other local, Federal and State agencies with membership on the PDT. Each of these stakeholders has an interest in maintaining levee stability on McCormack-Williamson Tract and preventing a catastrophic breach that inundates the island.

Key Messages: There are several key messages associated with the Levee Stability Program and the MWTFS that we need to stress to our target audiences. These include:

- There is serious need for short-term actions and a long-term strategy to improve levee stability in the Delta because people's lives, properties, and vital resources of statewide and national importance are threatened. The short-term strategy is to move quickly to construction on high priority levee reconstruction projects identified in the May 2006 CALFED Levee Stability Program Report to Congress on the U.S. Army Corps of Engineers Strategy for Action (e.g., McCormack-Williamson Tract);
- Levee Stability projects are critical to meeting the flood risk management, ecosystem restoration, water supply, water conveyance and water quality needs of the Sacramento-San Joaquin Delta and the State of California;
- The protection of the Delta's economic and agricultural productivity, and of its environmental resources, is important to the security, economic development, and environmental benefits for the Nation;
- Projects listed in the May 2006 Report to Congress are already authorized by Section 103(f)(3)(A) of PL 108-361, and approval for these projects resides with the Commander, South Pacific Division;
- The Levee Stability Program is not a typical USACE program and, as such, projects under the program will require a different process in the amount of planning and reporting that USACE feasibility studies typically require;
- The McCormack-Williamson Tract has multiple objectives that are within the Levee Stability Program authorization of levee stability and ecosystem restoration.
- The Levee Stability Program in the Delta can be undertaken for the benefit of both people and the environment.

Communication Goals: This communication plan will focus on interacting with both internal and external stakeholders. For both internal and external communications, the USACE and sponsor will use consistent messaging to build relationships and mutual understanding about the project.

In general, the concepts from this Communication Plan will be used to:

- Solicit two-way communication and engagement with stakeholders, including TNC (the landowner of the McCormack-Williamson Tract), adjacent landowners, public and interested local, state, and Federal agencies to ensure that their input and ideas are addressed.
- Address internal USACE communication during the course of the study effort.
- Actively reach out to agencies which will be directly impacted by implementation of alternatives for the MWTFS, such as the CA State Lands Commission and Regional Water Quality Control Board.

Outreach Strategies: In order to assist our team in achieving our communication goals, our team will participate in a number of opportunities to better provide clear and transparent communication in regards to the MWTFS. Below are some of the methods that we intend to utilize.

1. USACE and sponsor will engage interested local, state, regional, and Federal agencies and provide updates on the progress of the MWTFS through coordination and/or attendance at the Delta Communication Forum, as well as through the USACE Delta Newsletter.

2. With respect to internal USACE communication and coordination with other Delta programs, study efforts and initiatives, several standard operating procedures will be employed. Monthly PDT meeting will be conducted to ensure the team members are updated with the latest information regarding the progress of the study effort, and to identify issues that need to be addressed. Additional internal USACE meetings will be scheduled by the Team Lead Planner and Project Manager as required. The Lead Planner for the Levee Stability Program and a representative from the Project Management Branch will also participate in the Delta Regional Initiatives Team meetings that occur on a monthly basis. One of the key purposes of the Delta Regional Initiatives Team is to coordinate and convey information regarding related USACE and other agency projects, studies, and initiatives within the Delta, and to ensure proper USACE coordination, communication, and/or participation has been determined and implemented. Finally, an update on the MWTFS should be provided to the Public Affairs Office for inclusion in the USACE Delta newsletter.

3. With respect to external communication, a study information meeting will also be undertaken during the release of the Draft PIR and EIS to solicit input from the public and other interested parties and stakeholders. For the public meeting, fact sheets on the project will be prepared by CESPK, with assistance from the sponsor. The Corps, RD 2110, and DWR will develop illustrations and photos for use during the public workshop and for publication in the draft PIR and EIS. These illustrations and photos will show the scour locations, the cross sections of the levees, the proposed cross-cut channel, the ecosystem restoration areas, and other details about the project alternatives being considered. In addition, the PDT will develop maps for use during the public workshop to portray the locations of significant features in and adjacent to the study area and within the Delta. It is anticipated that the public workshop would be conducted during the October/November 2011 timeframe.

There will be no news releases (not including the monthly USACE Delta Newsletter) other than advertising of public notices, as required by NEPA, prior to and after the public workshop on the project – unless this communication plan is updated to include outreach efforts to be implemented during the design and construction of the project.

V. LESSONS LEARNED/NEXT STEPS

This section will be completed following the implementation of this communication plan, and will address After Action Reports (AARs), lessons learned and next steps that can be applied to additional public outreach and involvement during the design and construction phase of the project, as well as communication plans for other studies within the Levee Stability Program.

This page intentionally left blank

APPENDIX E

Geospatial Data Management Plan

This page intentionally left blank.

US Army Corps of Engineers®

Geospatial Data Management Plan

Division	**South Pacific (CESPD)**
District	**Sacramento (CESPK)**
Date	**April 16, 2010**
Project	**McCormack-Williamson Tract**
Location	**Sac – San Joaquin Delta**
P2 Number	**328768**

Project/Program Manager: Dennis Clark
Approval Signature: **Date:**
Geospatial Technical Lead : Casey Young
Approval Signature: **Date:**

☐ Cover Sheet Copy Sent to Division eGD&S Manager by District Geospatial Technical Lead
Date:

Cover Sheet

Geospatial Data Management Plan

1. Introduction

The Geospatial Data Management Plan (GDP) integrates geospatial data management into the Project Management Business Process (PMBP) and facilitates the implementation of enterprise data management. This data collection and management plan covers Computer Aided Design and Drafting (CADD) and Geographic Information System (GIS) products. Implementation of this plan will allow project delivery teams (PDTs) comprised of experts from various districts to work collaboratively on a project. For this collaboration to become a reality, the U.S. Army Corps of Engineers (USACE) must follow established criteria, policy and guidance for the acquisition, processing, storage, distribution, and use of geospatial data. Project delivery team members who are responsible for collecting spatial data and producing Computer Aided Design and Drafting (CADD) and Geographic Information System (GIS) products have a major role to play in the success of this effort.

1.1 Applicability

This plan shall apply to all district civil, HTRW, and military projects that will have a geospatial component at any phase of the project. Scopes of work and project management plans shall address the geospatial data component of the project to make sure that data is being collected, used and managed in such a way as to maximize its value throughout the life-cycle of the project and the related programs.

1.2 Funding

Funding for the preparation and implementation of this plan shall be provided by the individual project to which it applies.

1.3 Geospatial Responsibilities of the PDT

The PDT needs to define:

- Data objectives and quality requirements
- Data format
- Data collection methods and what data are available, in development, or stored (both on- and off-site). Timeliness of data availability.
- Data analysis and access - the uses of the data.
- How to incorporate this data into the project decision process.
- Data access, storage and control - how the data will be managed over time.

1.4 Role of the Geospatial and CADD Specialists on the Project Delivery Team (PDT)

- Support the PDT in the efficient execution of civil, HTRW, military construction and environmental restoration projects.
- Help protect the investment in CADD, geospatial data, applications and institutional knowledge.
- Facilitate the sharing of CADD and geospatial data among civil, military and environmental projects.
- At the project initiation phase determine how large of a role CADD and geospatial technologies will play.

- Educate the project managers and PDT members on how CADD and geospatial technology can be used to add value to the project.
- Identify CADD and geospatial data requirements and ensure that the appropriate CADD, geospatial, and data model and data standards are followed. This includes following the current A/E/C CADD standard, Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) and development of FGDC metadata.
- Acquire existing geospatial datasets from federal, state, local agencies, the public domain and available through USACE licenses agreements.
- Reformat data as required for use with the geospatial technologies.
- Create new data layers through the integration of existing and acquired data.
- Integrate CADD and GIS data.
- Identify CADD and geospatial application requirements needed for the project.
- Develop geospatial technology applications in accordance with applicable guidelines and standards.
- Perform spatial analysis and data modeling.
- Provide data visualization and mapping products.
- Develop and maintain a geospatial data management plan for the life cycle of the project.

1.5 Geospatial Data Checklist

This checklist will be completed by project geospatial technical leads to ensure project efforts to collect geospatial and geotechnical data meet required configuration, system, and data quality requirements.

All projects that include tasks to use or produce geospatial data must clearly state what will be collected, what will be delivered, the format it will be delivered in, and who will be responsible for updates and maintenance. This is necessary whether the work is done by contract or by District staff. This checklist is designed to aid project team members with writing geospatial data collection and management portions of the Project Management Plan (PMP). **This checklist is to be filled out by the Project Manager and the project's geospatial data technical lead.** This checklist becomes a permanent part of the project's geospatial data plan and subsequently the project's PMP.

I. Project/Contract Specific Information.

1. Project Title: McCormack-Williamson Tract

2. Proposed Contractor/In house: In-house

3. USACE Project Manager: Dennis Clark

4. Geospatial data technical lead: Casey Young

II. Identify project geospatial data requirements. Do not automatically assume that there is a geospatial or geotechnical data requirement. These questions are intended to develop a rationale for identifying such a requirement.

1. Why is this effort being undertaken and why is there a geospatial or geotechnical data aspect? The project is a very spatially diverse region with many different land uses/ownerships/boundaries. A spatial perspective of the project will allow for the necessary

decisions for uses of the fiscal resources. Many reports/proposals/presentations will be necessary. GIS will be used to convey the right ideas of the project progress.

2. What types of data will be collected? (e.g. soil samples, acquire aerial photographs, well construction information, etc.) Many types of data may be collected. It is uncertain of everything at this time. Some known layers may include aerial photos, CADD as-builds of levees, geotechnical data, known wells, and geology soil types.

3. How will this data be used now and in the future? (e.g. generate annual reports)
Data may be used in the future in relation to the lifetime of the project and may be used in conjunction with many other projects that take place in and around the California Delta.

4. Check the following that apply to proposed data.

☐ Data will not contain location (geospatial) or (geotechnical) information. *Does not require inclusion in the District's GIS.*

☒ Data contains location (geospatial) or (geotechnical) information. This information will not be altered in the future (i.e., is temporary in nature, such as proposed well locations). This information will not need to be accessible for use in other mapping projects in the future.

☒ Data contains location (geospatial) or (geotechnical) information. All or a portion of the data may be used on future maps but the graphic attributes will never need to be queried. *Data may be stored as electronic graphic files (i.e., CAD or GIS or image files) without database connection in the District GIS, to allow creation of new maps* (e.g. report showing work site boundaries).

☒ Data contains location geospatial or geotechnical information. Will require queries and modeling to be performed on the data and its attributes in the future. *This is a potential District GIS data set* (e.g. location and concentration of contaminants at a cleanup site). Deliverables must conform to the specifications of the District's GIS.

5. HQUSACE standards compliance reporting database requirements.

Project must be entered into HQ USACE GIS/CADD standards compliance website and the database must be updated at major project milestones.

☐ Completed

☒ Not Completed, At this time, this has not been completed

III. Identify proposed datasets using above information:

1. Which data sets should be included in the District eGIS? Do data structure or models (tables, etc) for this data already exist in the District eGIS or elsewhere in the Corps or will new tables, GIS layers, etc. need to be developed and added to accommodate this new data?

Data Set(s) & their SDSFIE feature class:

Data Set	Dist. GIS Data Level (1,2,3)*	SDSFIE or A/E/C Category	New	Update
LiDAR	2	A/E/C	X	
Bathymetry	2	A/E/C	X	
Parcel Data	2	A/E/C	X	
Land uses	2	A/E/C	X	
Utility Data	2	A/E/C	X	
Road Networks	1	A/E/C	X	
Other General Land Use Data	2	A/E/C	X	
1 = Corporate data, must be SDSFIE or A/E/C-compliant if produced by USACE, stored in geodatabase, FGDC compliant metadata required 2 = Project data, must be SDSFIE or A/E/C-compliant if produced by USACE, stored on file server, some metadata required 3 = Interim data, must include metadata if stored on file server more than 30 days				

2. Include the appropriate CADD/GIS standards and specifications in the SOWs (for contracted work) or reference them in the PMP (for in house work).

IV. Data Acquisition

Is the data already available ☒ Yes ☒No

☐ Geo-1-Stop checked for available data

☐ NSDI geospatial clearinghouse search completed

☐ Satellite data coordination coordinated

1. Data acquired from Other Federal, State or Local Agencies, Stakeholders, Partners, etc.

The geospatial specialist and applicable PDT members shall insure that the data obtained from external sources is used appropriately with regard to any licensing or security issues. Data acquired from these sources are **not** required to be converted to SDSFIE.

Data Use Category (if applicable) :
☒ "For General Use" ☒ Sensitive ☐ "Official Use Only" ☐ Other

Data Collected by In-House or Contract Labor

If the data does not exist, PDT members requiring the data shall be responsible for writing the scope of work for collection and delivery. The geospatial specialist shall assist with the scopes as needed and/or review them to insure that the data is collected and delivered as follows:

- In accordance with the standards specified in reference 15, Technical Report CADD-03-, dated July 2003, Subject: Contract Language Guidelines for Acquiring Geospatial Data (CADD, GIS, Computer Aided Facility Management [CAFM]) System Deliverables from Architect-Engineer (A-E) Consulting Firms.
- In accordance with the guidelines provided in reference 9, Engineer Manual 1110-1-2909 Geospatial Data and Systems, 30 September 05
- In compliance with the latest version of the SDSFIE.

- Provided with Federal Geographic Data Committee (FGDC) metadata.
- Provided in proper digital format.

When the data is received the geospatial specialist and/or PDT member shall review the deliverables for compliance with the requirements above.

Data Purchased from Vendor

☐ Data needs to be purchased
☐ Source & Associated cost
☐ Licensing and sharing agreements for data reviewed

CADD and Geospatial Data Delivery and Management

☒ CADD Data Mgmt: ☐ ProjectWise ☐ Other _____

☒ GIS Data Mgmt: ☐ ProjectWise ☐ FTP ☐ Other_____

CADD Data Delivery: District PDT is to determine if CADD data that is geospatial in nature such as site plans, channel boundaries and depths, utilities, building locations, etc. will be converted into a GIS geodatabase format by either the geospatial specialist or provided as a deliverable from contractor. This will ensure the District has data in a GIS format for future use/analysis.

Geospatial Applications, Analysis and Modeling Needed for the Project:

☒Website ☒Geodatabase ☒Database integration with GIS

☐Surface Generation ☒ Hydrographic Models ☒3D Models

☒ Site Selection Analysis ☒Area/Volumetric computations ☐sediment transportation

☒ Flood plain delineation ☐Other_____

Deliverable Format.

Note: All geospatial and geotechnical data deliverables must comply with the standards and specifications of the District's CADD/GIS Enterprise Geospatial Data System (eGDS). Included in this are standards for complete metadata regarding the data collection and processing of the data.

1. What file format(s) will be used to prepare the project's geospatial data deliverables?

Geospatial data (shape file or personal geodatabase for GIS, Microstation for CADD, is preferred, must conform to the SDSFIE for GIS or A/E CADD Standard for CADD)

Data format: ☒ ASCII text comma delimited file (tables with column headings and point data only)
☒ ESRI shape file
☒ ESRI coverage
☒ ESRI personal geodatabase
☒ ESRI SDE geodatabase
☒ Microstation/AutoCAD

☐ Other: _____

Horizontal Datum:
- ☐ WGS 84
- ☒ NAD 83 (Preferred)
  - ☐ NAD 27
  - ☐ Other: _____

Vertical Datum:
- ☒ NAVD 88 (Preferred)
- ☐ NAVD 29
  - ☐ Other: _____

Coordinate System/Zone:
- ☒ State Plane
  - ☐ _____North
  - ☐ _____ South
  - ☐ _____ East
  - ☐ _____ Central
  - ☒ Ca. zone 2 and 3 West
  - ☐ Other: _____
- ☒ Universal Transverse Mercator (UTM)
  - ☒ Zone 10
  - ☐ Zone __
  - ☐ Zone __
  - ☐ Other: _____
  - ☐ Other: _____
  - ☐ Other: _____

Projection:
- ☒ Geographic
- ☒ Transverse Mercator
- ☐ Lambert Conformal Conic
- ☐ Albers
- ☐ Other: _____

Horizontal measure:
- ☒ Feet
- ☒ Meters
- ☒ Latitude/Longitude
- ☐ Other: _____

Vertical measure:
- ☒ Feet
- ☒ Meters
- ☐ Other: _____

2. Will the contractor/PDT members produce a completed data package or will the project's geospatial data technical lead complete the deliverable? In most instances, the geospatial data technical lead at minimum will need to review that data and *load* it into the District's eGIS. If the contractor is to complete the data package, please indicate why this option is necessary.

☐ Contractor/PDT
Justification: _____

☒ Project geospatial data technical lead

3. Does the contractor/PDT require a copy of or access to the existing applicable District CADD/GIS data? If not, please provide justification. Some data that is needed may already exist within the district. This data may have to be researched and found and put into a District eGIS.

4. Will the contractor/PDT be responsible for ensuring the data is compatible with the current District CADD/GIS data standards? If not, please provide justification._____

☒ Contractor/PDT has been provided with a **current** copy of the Data Standard

☒ Contractor/PDT will contact the USACE POC regarding Data Standard requirements

5. Where will the GIS work be accomplished (location)? Most GIS work will be done in-house, with additional data sets to be supplied by the sponsor

6. Will the contractor/PDT be using their own or Geospatial Data Section-furnished GPS equipment and GIS workstations?

GPS source: ☐ NA ☒ Contractor/PDT ☒COE ☐ COE to provide training

7. Will the contractor perform post-processing on GPS data?

Post-Processing: ☐ NA ☒ Contractor/PDT ☒COE ☐ COE to provide training

8. Metadata:

☒ Contractor/PDT will provide sufficient documentation regarding the electronic deliverable files as delineated in the District's CADD/GIS data standard.

Geospatial Support to Customers

Customer was contacted to determine compatibility of project data with their systems/policies?

☐ Yes ☒ No ☐Notes No customer for GIS data

Data is complete and compatible with customer's CADD system and eGIS:

☐ Yes ☒ No ☐Notes No customer for GIS data

V. Data Maintenance

1. Maintenance and Updates:

☐ This is a one-time data delivery.
☒ Contractor/PDT will provide regularly scheduled data updates to be added to existing files and tables.
☒ Contractor/PDT will provide maintenance and regularly scheduled complete updates of the entire table contents and associated graphics.
☒ The project's geospatial data technical lead will provide required maintenance and updates to data.

2. ☒ Project deliverables must be cataloged in the District's geospatial data inventory database.

VI. Approval

1. Project Manager:

Name: Dennis Clark

Signature: _____ Date: _____

2. Geospatial Data Technical Lead:

Name: Casey Young

Signature: _____ Date: _____

APPENDIX F

Project Guidance Memorandum

This page intentionally left blank.

INSERT PROJECT GUIDANCE MEMO

This page intentionally left blank.

APPENDIX G

Quality Control Certification for PMP

This page intentionally left blank.

QUALITY CONTROL CERTIFICATION

PROJECT MANAGEMENT PLAN
McCormack-Williamson Tract Feasibility Study

COMPLETION OF QUALITY CONTROL ACTIVITIES

The District has completed the Project Management Plan (PMP) for the McCormack-Williamson Tract Feasibility Study. All quality control activities defined in the District's Quality Management Plan for PMPs have been completed. Compliance with clearly established policy principles and procedures, using justified and valid assumptions, has been verified, including whether the PMP meets the non-Federal sponsor's needs and is consistent with law and current Corps policy. All issues and concerns resulting from the DQC Review of the PMP have been resolved.

Aug 2, 2010
Date

Sara Schultz
Senior Planner, CESPK

CERTIFICATION

Certification is hereby given that (1) the DQC process for this PMP has been completed; (2) all issues have been addressed; (3) the streamlining initiatives proposed in this PMP will result in a technically adequate product; and (4) appropriate quality control plan requirements have been adequately incorporated into this PMP. In summary, the study may proceed with the feasibility phase in accordance with this PMP.

3 Aug 10
Date

Alicia Kirchner
Chief, Planning Division, CESPK

This page intentionally left blank.

Appendix E: Adaptive Management Plan

Research Topic	Research Questions (Performance Measures)	Hypotheses (Success Criteria)	Potential Research Opportunities (Adaptive Management Responses)
Floodplain Processes	Is frequency of flooding by way of east levee and through the secondary channel? It is expected that annual flood frequency would be by way of secondary channel? Floodplain area (area flooded) is expected to be 400 acres. Does riparian habitat (starting with 200 acres along channel) increase over time to replace grassland (an additional 150 acres)? Does scour and deposition occur? Especially by water through floodplain channel? How do flooding and tidal processes interact?	Appropriate frequency of flooding to achieve multiple ecosystem restoration objectives. Appropriate flood plain area to achieve multiple ecosystem restoration objectives Scour and deposition are occurring at the site at an acceptable rate without damaging wildlife-friendly levees, etc. Flooding and tidal processes are compatible (e.g., flooding does not destroy formation of tidal channels or conversely filling of the McCormack-Williamson Tract with water from tidal processes does not inhibit riverine processes').	If there is a need to change frequency of flooding, adjust height of east levee and/or inflatable dam. Raise to increase frequency water shunted to Mokelumne River breach. Lower to increase frequency McCormack-Williamson Tract floods over east levee. May be restricted from lowering east levee below 8.5' msl due to access issues. If floodplain area is too small or too large, change factors that affect hydrology (east levee height, channel configuration). If scour and deposition are not occurring, change factors that affect hydrology (east levee height, channel configuration) to increase hydraulic energy. If scour and deposition are occurring too violently (such that the wildlife-friendly levees are threatened, for example), change factors that affect hydrology to lessen hydraulic energy or put in erosion protection. If flooding and tidal processes are incompatible (e.g., flooding destroys formation of tidal channels that are not reformed for many years, or conversely filling of the McCormack-Williamson Tract with water from tidal processes inhibits riverine processes), decide whether to preserve flooding (and raise southern levee to height inhibiting tidal action) or preserve tidal processes and inhibit flooding by raising east levee or closing off secondary channel.
Sedimentation/ **Geomorphic Processes**	What are the sedimentation rates in and around the secondary channel, floodplain, dendritic intertidal wetlands and southern shallow-water habitat area?	Sedimentation is occurring but not at rates that are higher than expected in secondary channel.	If sedimentation rates are higher than expected in secondary channel, is it still functioning to bring water onto the floodplain? If not, consider excavating channel further into the McCormack-Williamson Tract. If sedimentation is occurring in the northern portion of the McCormack-Williamson Tract, consider strategies (such as hydrologic changes or physical transfer) to transfer sediment to the southern portion of the McCormack-Williamson Tract.
Dendritic Intertidal Channels	Do they form as expected? Expect approximately 150	Dendritic intertidal channels form as expected.	If dendritic intertidal channels do not form as expected and instead there is emergent marsh or floodplain habitat, for example,

	acres of intertidal habitat at elevations -1' msl to 1' msl. Do channels dry out on tidal cycle?	Channels dry out on tidal cycle.	consider adjusting goals for that region to be the habitat that develops. If lack of channel formation is due to insufficient hydraulic energy, consider changes in the southern levee breach size and elevation or excavating starter channels that would increase the hydraulic energy. If elevations are not appropriate for formation of dendritic intertidal channels, consider relocating breaches. If channels do not dry out on tidal cycle, consider raising southern levee to eliminate the formation of tidal habitat and associated exotics or aggressive exotic species control. Install one-way flow gates or self-regulating tidal gates to facilitate draining of tidal channels.
Exotic Species Dominance	Does exotic aquatic vegetation predominate? Exotic fish? Native fish? Does aquatic exotic vegetation dominate perennial channel? Does aquatic exotic vegetation dominate intertidal wetlands? Does aquatic exotic vegetation dominate subtidal area in south? If so, does the subtidal area serve as a propagule source for exotic vegetation in the intertidal dendritic channels? Does terrestrial exotic vegetation predominate along permanent channel? Does terrestrial exotic vegetation dominate floodplain? Is it related to the flooding frequency? Does terrestrial exotic vegetation predominate on wildlife-friendly levees? Which part of wildlife-friendly levee	Native aquatic vegetation and fish predominate.	If exotic aquatic vegetation and fish predominate, consider aggressive exotic control measures or eliminating habitat by raising southern levee or installing water control gates If aquatic exotic vegetation dominate perennial channel, consider strategies to increase flow, use vegetation control methods or eliminate habitat by closing breach which allows channel formation. If aquatic exotic vegetation dominates intertidal wetlands, consider strategies to increase flow, use vegetation control methods or eliminate habitat by raising southern levee. If aquatic exotic vegetation dominates subtidal area in south, consider leveeing off southern area. If subtidal area serves as a propagule source for exotic vegetation in the intertidal dendritic channels, levee off subtidal area or use aggressive exotic vegetation control methods in subtidal area (may need to contain areas for treatment). If terrestrial exotic vegetation predominates along permanent channel, remove by cutting or other control methods, consider closing channel, changing factors that affect hydrology (increasing or decreasing water levels, for example), by changing breach or weir configuration. If terrestrial exotic vegetation dominates floodplain and is related to flooding frequency, change factors that affect hydrology/flooding frequency. Or use vegetation control methods.

	(emergent marsh, scrub-shrub or riparian habitat)? Do exotic fish predominate in channel? Do exotic fish predominate in intertidal dendritic wetlands? Do exotic fish dominate subtidal area in south? Do they serve as a source for exotic fish in the intertidal dendritic wetlands?		If terrestrial exotic vegetation predominates on wildlife-friendly levees (emergent marsh, scrub-shrub or riparian habitat), use vegetation control methods (including herbicides, goats, for example) and/or plant native species to displace exotic species. If exotic fish predominate in channel related to flow, increase flow by changing breach dimensions or use exotic fish control strategies. If necessary, eliminate habitat by closing breach. If exotic fish predominate in intertidal dendritic wetlands, control fish or hydrology by installing water control weirs, self-regulating tidal gates. Eliminate habitat by raising southern levee. If exotic fish dominate subtidal area in south, try control strategies (may have to isolate areas for treatment). If related to hydrology, change factors that affect hydrology. If the subtidal area serves as a source for exotic fish in the intertidal dendritic wetlands, levee off the southern subtidal area.
Fish Stranding	Do fish strand in northern floodplain area after flooding events? Expect fish to navigate to aquatic areas in south; however natural levees that form along starter channel may present a barrier to fish. Are fish stranded during the outgoing tide in the dendritic intertidal channels?	Fish do not get stranded in northern floodplain area after flooding events. Fish do not get stranded during the outgoing tide in the dendritic intertidal channels.	If fish strand in northern floodplain area after flooding events, consider filling in low areas where stranding occurs. Change flooding area by changing factors that affect hydrology. If secondary channel facilitates fish stranding, consider eliminating secondary channel by closing breach. If fish stranded during the outgoing tide in the dendritic intertidal channels, consider grading to facilitate drainage into the channels, eliminating low areas where ponding might occur or changing factors that affect hydrology (perhaps installing gates to mute tides).
Mosquito Management	Is there significant mosquito production in floodplain? During what months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in permanent channel? During what	Insignificant mosquito production in floodplain when flooded. Insignificant mosquito production in southern area where nekton gates circulate water.	If significant mosquito production in floodplain, consider mosquito control methods (such as insecticide), eliminating low areas where ponding might occur, improving drainage by grading. If associated with specific vegetation, consider controlling/changing vegetation. If hydrologic changes would lessen mosquito production without undue ecological effects, consider changing factors that affect hydrology. If significant mosquito production in permaner channel, consider control methods in channel

	months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in dendritic intertidal wetlands? During what months of year? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in subtidal area in south? During what months of year and what flow conditions? Is mosquito production associated with presence of vegetation? Is there significant mosquito production in floodplain when flooded (dry June-December)? During what months of year? Is mosquito production associated with presence of vegetation?		have to isolate treatment areas). If this occurs during certain flow conditions (such as low flo consider changes to channel geometry (narro channel, for example) to increase flow. If associated with presence of vegetation, consi removing or altering vegetation. If significant mosquito production in dendritic intertidal wetlands, consider control methods (insecticide), changing factors that affect hydrology (perhaps specific to certain seasons when mosquitoes are most problematic). If mosquito production associated with presence of vegetation, consider vegetation control. If significant mosquito production in subtidal area in south, use mosquito control measures, make changes that affect hydrology (perhaps increasing flow rates by creating additional breaches, removing vegetation or other obstructions to flow), controlling vegetation if mosquitoes are associated with vegetation, or building levees to isolate the subtidal area. If significant mosquito production in floodplain when flooded, use mosquito control (insecticide), increase circulation through additional breaches, control vegetation, or reduce area of floodplain habitat.
Methylmercury	Is mercury methylation on floodplain significant? Is mercury methylation in dendritic intertidal wetlands significant? Is mercury methylation in subtidal area significant?	Mercury methylation on floodplain is insignificant and not affected by hydrology. Mercury methylation does not vary by area of floodplain (water depth) during times when floodplain is flooded	If mercury methylation on floodplain significant and affected by hydrology (east levee height or secondary channel dimensions), adjust factors that affect hydrology. Consider eliminating habitat by raising east levee or closing Mokelumne River breach that forms secondary channel. If mercury methylation in dendritic intertidal wetlands significant and affected by hydrology, adjust factors that affect hydrology. Consider eliminating habitat. If mercury methylation in subtidal area is significant and affected by hydrology, change factors that affect hydrology. Consider eliminating habitat.

Organic Carbon	Is organic carbon on floodplain exported to channels during flood events? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels? Organic carbon production and export from permanent channel? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels? Organic carbon production and export in dendritic intertidal wetland area? Are there water quality (disinfection by-product precursor) effects at SWP or other drinking water diversions? Are there ecological benefits to biota in surrounding channels?	Organic carbon on floodplain is not exported to channels during flood events unlikely to increase organic carbon levels at SWP pumps. Self-regulating tidal gates and tidal circulation during flooded months (January-May) does not affect organic carbon production and export into adjacent channels.	If organic carbon on floodplain exported to channels during flood events and likely to increase organic carbon levels at SWP pumps and other drinking water diversions, consider holding water on-island and treatment or modifications to hydrology/flow paths that might lessen organic carbon export. Weigh against ecological benefits in channels due to organic carbon export. If organic carbon production and export from permanent channel significant, consider eliminating permanent channel, in-channel treatment, or preventing permanent channel from draining from island during certain time periods. (Since organic carbon loads are greatest during winter and time of most significant diversions, unlikely to be able to control organic carbon export during this time due to flooding conditions). If organic carbon production and export in dendritic intertidal wetland area, consider raising southern levee to eliminate habitat (assuming water quality effects outweigh ecological benefits).
Subsidence Reversal	Does accretion occur in the emergent marsh area? At what rate?	Accretion is occurring on the floodplain at an appreciable rate.	If accretion is not occurring in the emergent marsh area, consider other strategies such as adding brush boxes, changing hydrology by modifying the southern levee opening to enhance settlement.

Appendix F: Hydraulic Model

UNIVERSITY OF CALIFORNIA

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

William E. Fleenor, Ph.D.
Research Engineer

DEPARTMENT OF CIVIL AND
ENVIRONMENTAL ENGINEERING
UNIVERSITY OF CALIFORNIA
2001 ENGINEERING III
ONE SHELDS AVENUE
DAVIS, CALIFORNIA 95616
(530) 752-5669 Fax: (530) 752-7872
wefleenor@ucdavis.edu

February 17, 2011

Re: Tidal and Flood Hydraulic Modeling
(Appendix 3 of the North Delta Final EIR)

From 1999 through 2005 I had the responsibility and pleasure of supervising the work of three separate Master's Theses for the Center for Watersehd Sciences (CWS), a part of the John Muir Institute of the Environment (JMIE) at the University of California, Davis (UCD). These three students were Steve Blake, Chris Hammersmark and Raffi Moughamian and their work is included in the references of the report. The work had the further benefit of hydraulic modelling efforts of MBK Engineers and a science panel review of that work.

After the completion of the students' work, I personally performed the final modeling work, simulating the various flood scenarios and the proposed alternatives. Further, the hydraulic results of the modeling were provided to National Hydraulic Consultants (NHC) who are sediment transport exports. NHC performed the sediment work associated with the proposed alternatives.

I certify that all the work represents the best physical input available with a thorough process of implementation and verification, and the application of the best available science in the development of the model and its application. I have closely read Appendix 3 of the North Delta Final EIR and have found it to be accurate and complete in its representation of the work.

William E. Fleenor, Ph.D.

Tidal and Flood Hydraulic Modeling

Introduction

This appendix presents an overview of the development and application of the North Delta tidal and flood hydraulic model. The model, built on MIKE 11 modeling engine platform, was used for evaluation of tidal and flood hydraulic impacts from the North Delta Flood Control and Ecosystem Restoration Project Alternatives. The following information is provided in this appendix; the theoretical basis of the MIKE 11 model engine, development of the North Delta Project area MIKE 11 hydraulic model, calibration and validation of the model, model inputs and assumptions, and flood control and ecosystem restoration modeling results. Most of the work described herein was completed throughout the course of three University of California at Davis (UCD) Masters theses. Sediment transport and water quality modules of the MIKE 11 have also been developed to analyze changes/impacts in sediment transport and sediment budget for different proposed Project Alternatives. The sedimentation study has been discussed in Chapter 3 of the EIR.

MIKE 11 Model

The MIKE 11 model (DHI 2000), developed by the Danish Hydraulic Institute, is a dynamic, one-dimensional modeling package, which simulates the water level and flow splits throughout a river/channel system. In addition to simulating hydraulics, the modeling package also includes modules for advection-dispersion, sediment transport, water quality, rainfall-runoff, flood forecasting, and GIS floodplain mapping and analysis. The hydraulic and sediment transport modules were developed and used to analyze potential impacts and benefits of the North Delta Project.

MIKE 11 solves the vertically integrated equations of conservation of mass and momentum, known as the St. Venant equations. The St. Venant equations are derived from the standard forms of the equations of conservation of mass and conservation of momentum based on the following four assumptions:

- The water is incompressible and homogeneous; therefore, there is negligible variation in density.

- The bottom (channel bed) slope is small, therefore the cosine of the slope angle can be assumed to equal 1.
- The water surface wavelengths are large compared to the water depth, which ensures that the flow everywhere can be assumed to move in a direction parallel to the bottom.
- The flow is subcritical. Subcritical flow conditions are solved with a reduced momentum equation, which neglects the nonlinear terms.

With the four assumptions applied, the standard forms of the equations of conservation of mass and momentum can be transformed into the equations below. These transformations are made with Manning's formulation of hydraulic resistance in SI units, and the incorporation of lateral inflows in the continuity equation.

Continuity Equation: $\frac{\partial Q}{\partial x} + \frac{\partial A}{\partial t} = q$

Momentum Equation: $\frac{\partial Q}{\partial t} + \frac{\partial\left(\alpha \frac{Q^2}{A}\right)}{\partial x} + gA\frac{\partial h}{\partial x} + \frac{n^2 gQ|Q|}{AR^{4/3}} = 0$

where

Q: discharge [ft^3/s]

α: vertical velocity distribution coefficient

A: cross section area [ft^2]

g: gravitational acceleration [ft/s^2]

X: downstream direction [ft]

h: stage above datum [ft]

t: time [s]

n: Manning coefficient

q: lateral inflow [ft^2/s]

R: hydraulic radius [ft]

Within the MIKE 11 program, the above equations are transformed into a set of implicit finite difference equations, which are solved for each point in the grid (at each node). The above formulations of the St. Venant equations are further simplified for application in a rectangular channel. Natural river cross sections are rarely rectangular, so the MIKE 11 model integrates the equations piecewise in the lateral direction. In order to run the MIKE 11 model, several data inputs are required, including the river network alignment, channel and floodplain cross sections, boundary conditions and roughness coefficients.

The MIKE 11 GIS software package integrates MIKE 11 hydraulic model output with the spatial analysis capabilities of the Arc View GIS software developed by Environmental Science Resource Institute. MIKE 11 GIS, among other things,

projects the water levels calculated within MIKE 11 as an interpolated water surface over a digital elevation model (DEM). The difference between the water level and the ground elevation is determined throughout the domain and visually presented based upon user defined flood depth increments. This software is designed to assess flood extent and provide insight with regards to the regional ecology driven by the disturbance of flooding. For example, depth inundation maps have been generated with MIKE 11 GIS to evaluate the habitat restoration potential of North Delta ecosystem restoration scenarios on McCormack-Williamson Tract. This provides a powerful graphical tool when evaluating each scenario based upon defined management objectives.

North Delta MIKE 11 Model Development

UCD staff worked cooperatively with DWR staff and the Project area stakeholders to develop the MIKE11 model. Model development was completed through the grant-funded work of several graduate students whose efforts built upon the others in succession. The students' work is documented in three Masters theses: "An Unsteady Hydraulic Surface Water Model of the Lower Cosumnes River, California, for the investigation of floodplain dynamics," by Stephen H. Blake; "Hydrodynamic Modeling and GIS Analysis for the Habitat Potential and Flood Control Benefits of the Restoration of a Leveed Delta Island," by Chris T. Hammersmark; and "Water Quality Modeling and Monitoring in the California North Delta Area," by Raffi J. Moughamian.

The North Delta MIKE11 modeling efforts described in this Appendix were coordinated with other area modeling efforts, such as the development of a regional HEC-RAS, a one-dimensional hydraulic model developed by US Army Corps of Engineers. Most of the channel geometry and boundary condition for the North Delta MIKE11 model were obtained from those kinds of efforts.

Project Area

The Project area lies within Sacramento and San Joaquin Counties. The Cosumnes River, its forks, and tributaries extend into the counties of El Dorado and Amador, with the uppermost reaches of the Mokelumne found in Calaveras and Alpine counties (Blake 2001). Project area watersheds, including Cosumnes and Mokelumne River watersheds, are shown in Figure E-1.

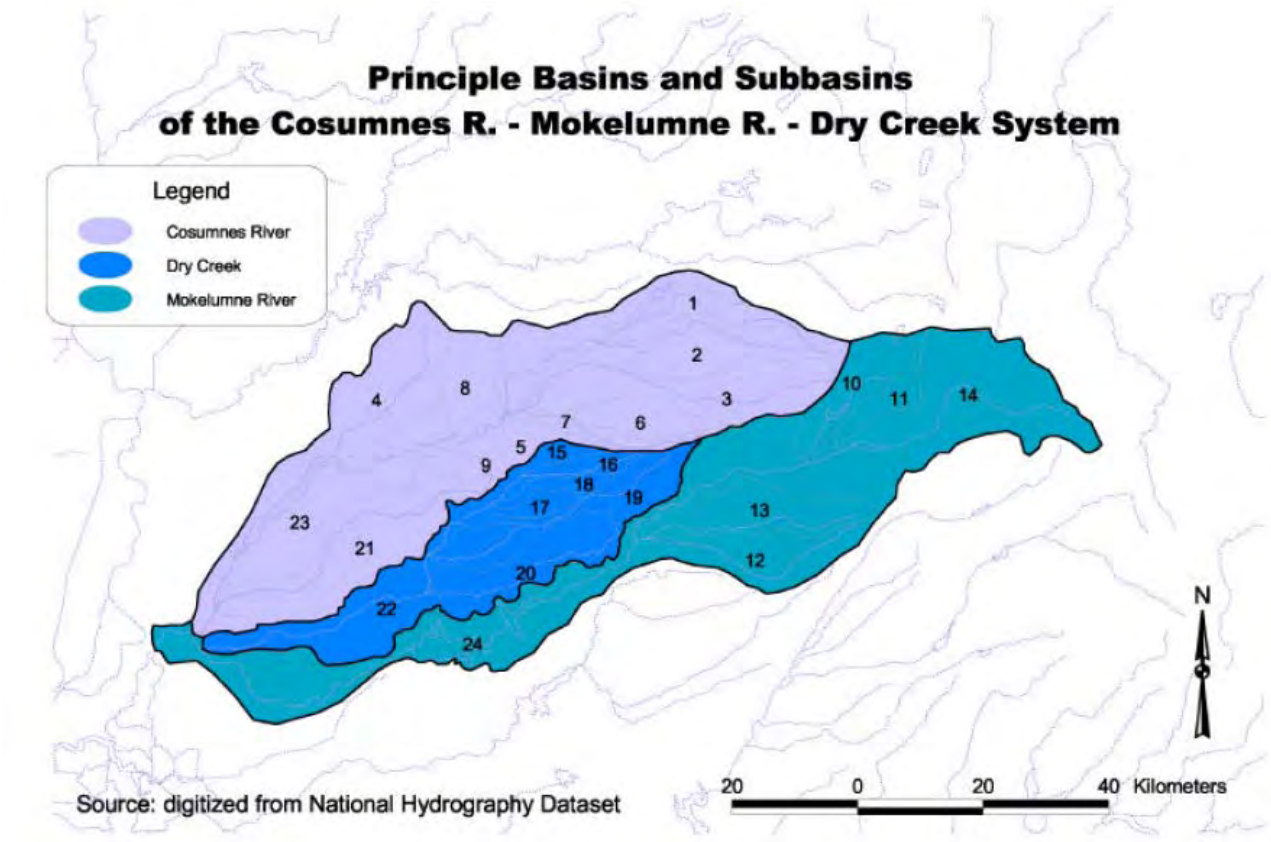


Figure E-1. Principle Basins and Subbasins of the Project Area

Model Geometry

The alignment of river channels, major sloughs, and floodplain areas in the North Delta model region dictates the model network of the hydraulic system for the Project (shown in Figure E-2). A total of 150 miles of river channels and sloughs are included in the model, not including the extensive off channel regions, which are also incorporated in the model network. The model utilizes 454 in-channel and floodplain cross sections obtained from a variety of sources (Hammersmark 2002). All cross section and boundary data are datum verified and translated as needed to the NGVD 29 datum (mean sea level).

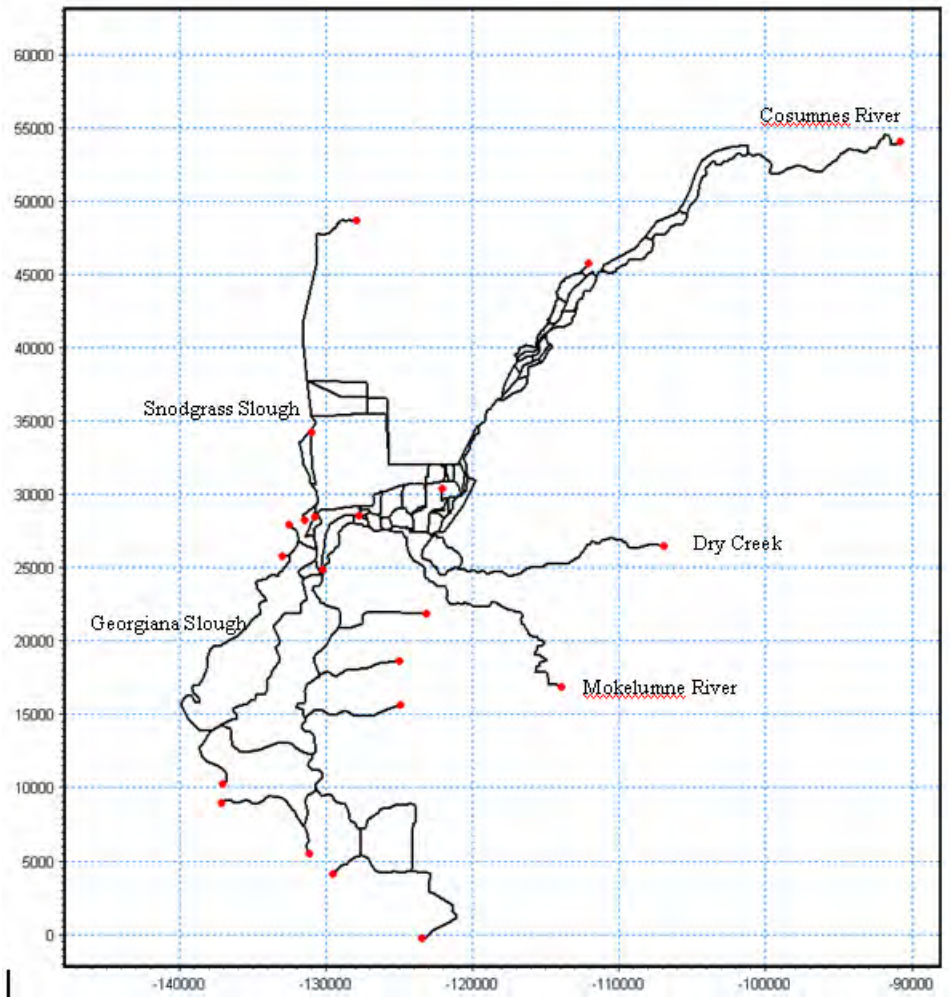


Figure E-2. North Delta MIKE11 Model Schematic (Model Domain)

Each river reach/branch is assigned a name and length in addition to its connectivity with the other branches in the model domain. The model incorporates the Cosumnes and Mokelumne Rivers, Dry Creek, Georgiana Slough, Snodgrass Slough, Morrison Creek Stream Group, the San Joaquin River, and many backwater sloughs to capture the hydrodynamics in the North Delta area. In this study, floodplains are identified as separate reaches in the model network, placed adjacent to the channel. The floodplain is then connected to the river reach with "link channels", which are basically simplified branches in which flow through the branch is calculated as flow over a broad crested weir, with user defined weir geometry. All levee breaches, in addition to floodplain connections have been simulated with this approach, providing a pseudo two-dimensional representation of floodplain flow. Detailed information on the model branch names, chainages, flow directions, and network connectivity can be found in Hammersmark (2002).

Topographic and cross section data for the original model development are detailed in Appendix A of the Stephen Blake thesis. Geometric data in the form of cross sections and digital elevation models from a variety of sources including USGS, CA-DWR, University of California at Davis (UCD), EBMUD, SAFCA, Phillip Williams and Associates (PWA), California Department of Transportation BIRIS system (BIRIS), Sacramento County Public Works Department, San Joaquin County Public Works Department, and the National Oceanic and Atmospheric Administration (NOAA) were used to develop the model. The data was collected in various forms such as DEMs, AutoCAD drawings, binary data sets used in other modeling platforms, field surveys, as-built drawings of bridges, and output from an NOAA NOS lidar mission. The data were location and datum verified, processed, and compiled into a cross-sectional database in MIKE 11. Figure E-3 presents the location and source (where available) of each cross section used in this effort.

Topographic data for large floodplain areas where no formal survey data exists were extracted from the USGS 30-meter DEM. These areas include Glanville Tract, Dead Horse Island, Erhardt Club, New Hope Tract, and Tyler Island. Topography data for the McCormack-Williamson Tract were obtained from the North Delta Study conducted in 1992 by DWR, and then partially verified for significant changes in the topography from the original survey (Hammersmark 2002).

Boundary condition data were gathered from a number of gages in the North Delta Project area. Those data were provided by a number of agencies including United States Geological Survey (USGS), California Department of Water Resources (CA-DWR), East Bay Municipal Utilities District (EBMUD), and Sacramento County Flood Control Agency (SAFCA). The availability of hydraulic gage data somewhat dictates the boundaries of the North Delta MIKE 11 model domain. The model extends upstream to hydraulic gages located at Michigan Bar on the Cosumnes River, Wilton Road on Deer Creek, above Galt on Dry Creek, Woodbridge on the Mokelumne River, and to Lambert Road at the Stone Lakes Outfall. To the west, the model includes a short portion of the Sacramento River extending from above the Delta Cross Channel to below the divergence of Georgiana Slough. There are four downstream boundary conditions on the San Joaquin River including the San Joaquin River at San Andres Landing, Venice Island, Turner Cut, and Rindge Pump. Gage data from two internal locations, Benson's Ferry and New Hope, were used as calibration and verification points. Figure E-4 shows the locations of the North Delta MIKE11 boundary conditions. Types of boundary condition data used are listed in Table E-1.

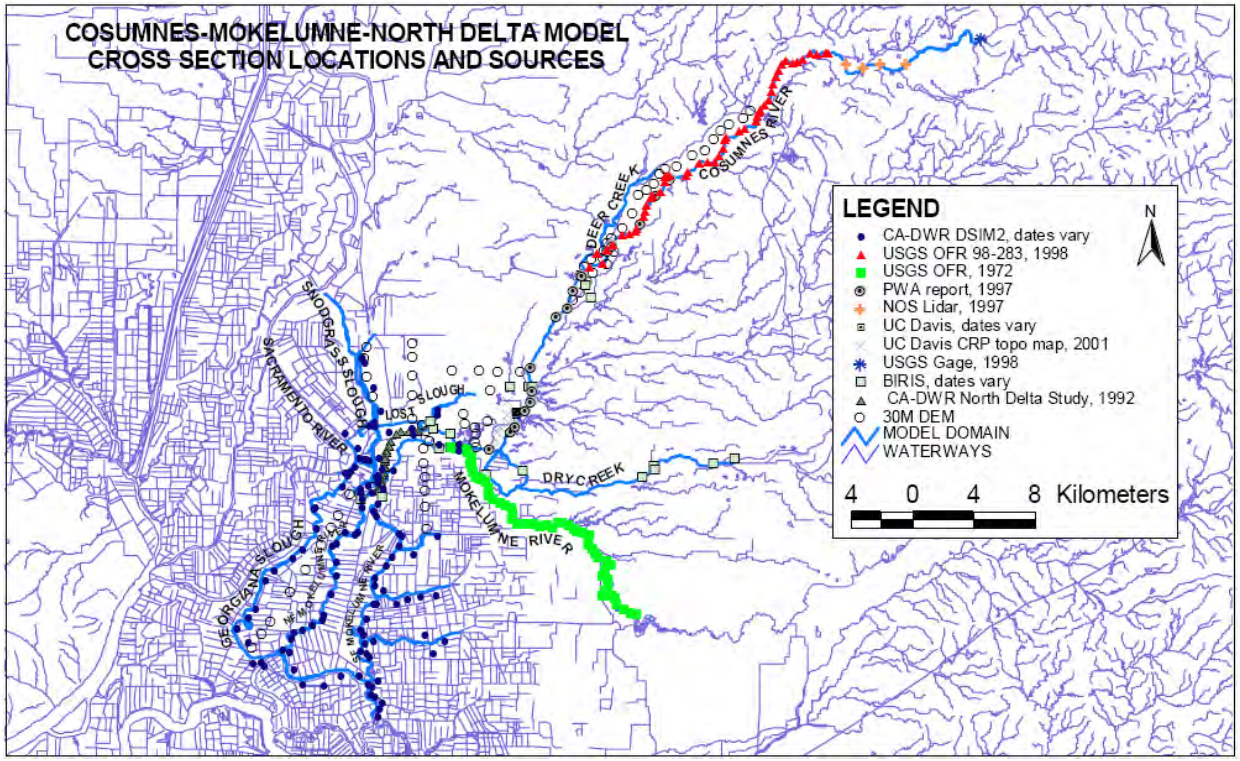


Figure E-3. Cross section locations and data sources used in the North Delta Model.

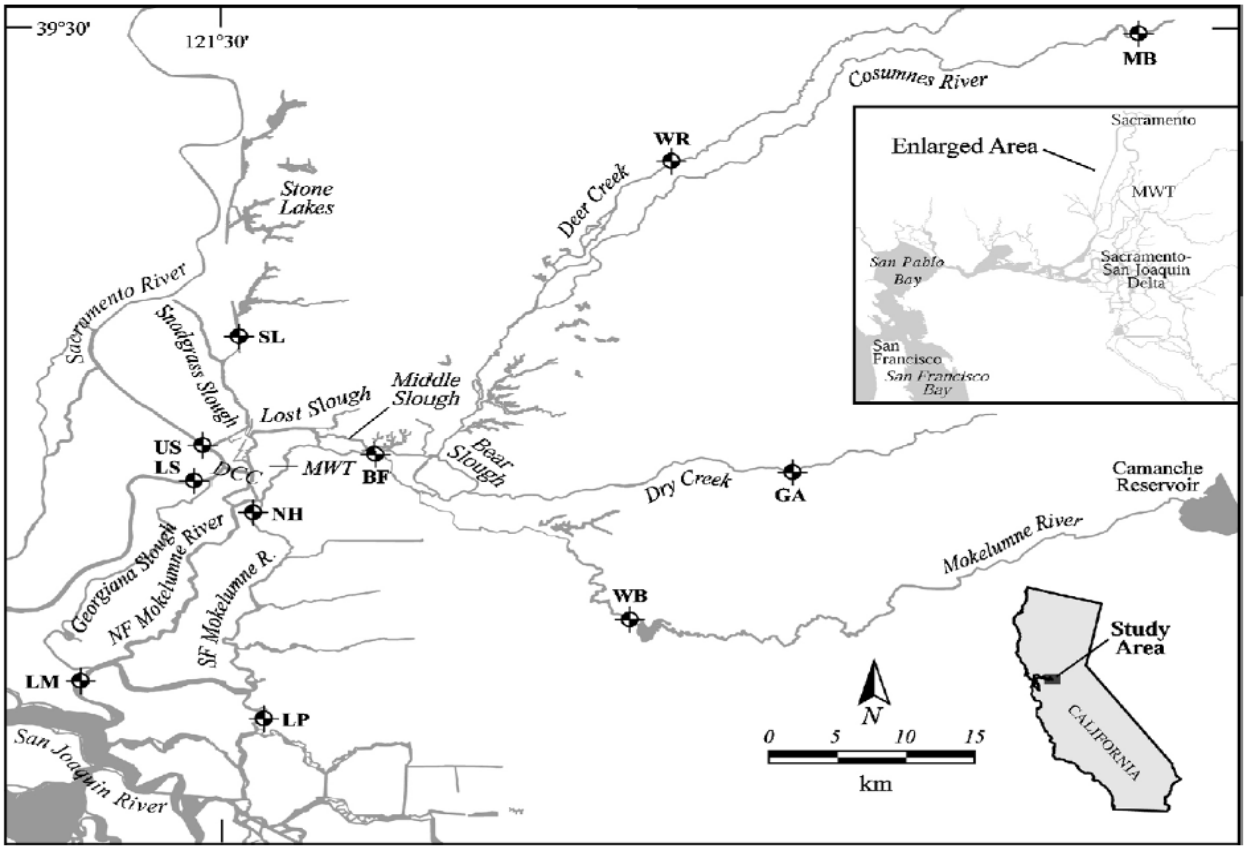


Figure E-4. Regional and Local Setting of the McCormack-Williamson Tract and Location of Gages Used for Boundary Conditions and Internal Validation Points.

Model result validation and scenario comparison is conducted at Benson's Ferry (BF) where the Cosumnes River converges with the Mokelumne River and at New Hope (NH) where the North and South Forks of the Mokelumne River diverge. Model boundary conditions are labeled as follows: MB: Michigan Bar on the Cosumnes River, WR:Wilton Road on Deer Creek, GA: Galt on Dry Creek, WB:Woodbridge on the Mokelumne River, SL: Stone Lakes Outlet at Lambert Road, US: Sacramento River above the Delta Cross Channel (DCC), LS: Sacramento River below Georgiana Slough, LM: Lower Mokelumne River at Georgiana Slough and LP: Little Potato Slough below Terminous.

Table E-1. Hydraulic Model Boundary Condition Data Type

Hydraulic Gage Location	Sensor ID	Agency	Simulation Year/Data Type[1]				
			1986	1997	1998	1999	2000
Upstream Boundary							
Cosumnes River @ Michigan Bar	RCSM075	USGS	Q&h	Q&h	Q&h	Q&h	Q&h
Sacramento River upstream of the DCC	RSAC128	USGS	--[2]	Q&h	Q&h	Q&h	Q&h
Dry Creek upstream of Galt	DRY1	USGS	Q	e	e	e	e
Mokelumne River at Woodbridge	RMKL070	EBMUD	Q&h	Q&h	Q&h	Q&h	Q&h
Deer Creek at Wilton Road	DEER2	SAFCA	E	Q&h	Q&h	Q&h	Q&h
Stone Lakes Outlet at Lambert Road	SGS1	SAFCA	e	h	h	H	h
Downstream Boundary							
Sacramento River downstream of Georgiana Slough	RSAC121	USGS	h	Q&h	Q&h	Q&h	Q&h
San Joaquin River at San Andres Landing	B95100	DWR	h	h	h	h	h
San Joaquin River at Venice Island	B95580	DWR	h	h	h	h	h
San Joaquin River at Turner Cut	--	DWR	h	h	h	h	h
San Joaquin River at Rindge Pump	B95620	DWR	h	h	h	h	h
Internal Boundary							
Mokelumne River at Benson's Ferry	RMKL027	DWR	h	h	h	h	h
South Fork Mokelumne River at New Hope Landing	RSMKL024	DWR	h	h	h	h	h

[1] Q = discharge, h = stage, e = estimated as explained in text

[2] For the 1986 simulation, stage data at Sacramento River downstream of Georgiana Slough were used for the upstream end of Georgiana Slough and the Sacramento River reach was removed from the model network.

Data collected at different times, and by different agencies does not always utilize the same reference datum, and in some cases does not document the

reference datum used. To ensure uniformity and confidence in the modeling results, data from each source have been datum checked and converted as needed to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Bridges and Structures

All bridges and structures were included in the model as cross-sections to allow the model to calculate the effects of the restrictions. The data for the bridges came from the State and County drawings available for the structures, and the data for the DCC from the USBR 'as built' drawing number 214-D-16819.

Roughness Coefficients

The MIKE11 model requires the input of channel roughness in each reach for calculating water surface elevations. Roughness values were input by designating a roughness coefficient, Manning's n for each reach. The value of this coefficient depends on many things, but primarily upon bed and bank materials, the amount of vegetation, and channel irregularity. For this Project, a number of n-value tables and photographs were used to estimate "n" values for various regions of the model domain. The final values are shown in Table E-2. More detail on the method of choosing the Manning's n values is given in Hammersmark (2002).

Table E-2. North Delta MIKE 11 Manning Coefficients

Manning's "n"	Global value[1]	Cosumnes River[2]	Deer Creek	Dry Creek	Delta Islands and Tracts	Floodplains
	0.036	0.04	0.05	0.05	0.05	0.1

[1] The global value was applied to all model regions unless otherwise specified.

[2] For the 1986 runs, Cosumnes River "n" value was increased to 0.045 to account for the increases effect of vegetation at high water levels.

Calibration and Validation of the Model

For a successful comparative evaluation of Project Alternatives, it is important to have a well calibrated and validated hydraulic model. The MIKE 11 model for the North Delta Project was calibrated and validated for a range of flows to ensure that the model was capable of simulating a range of storm events. This section documents the flow data used for calibration and validation, the methodology, and comparisons between model outputs and the measured data.

Flow Data

The range of flows, considered for modeling the Project Alternatives, varies from a 2.5-year to over 200-year return interval at Michigan Bar. The return interval for various flood pulses at Michigan Bar has been chosen as the distinguishing variable because the Cosumnes River is the dominant source of floodwater to the North Delta region. Michigan Bar has a comparatively long record of gage data. The return interval or flood recurrence interval is defined as the expected period of time within which a flood of a given magnitude will be equaled or exceeded. In other words, the chance that a 50-year recurrence interval flood will occur in a given year is 1 in 50.

Flood frequency analyses were performed by the USGS for the Cosumnes River based upon 91 years of data (1907-1997) recorded at the Michigan Bar gaging station (Guay et al. 1998). Philip Williams and Associates (PWA) performed another flood frequency analysis for the Cosumnes River based upon 89 years of data (1907-1995) recorded at the Michigan Bar gaging station (Vick et al 1997). As well, David Ford Consulting Engineers Inc. performed a flood frequency analysis as part of work prepared for Sacramento County. These flow frequency analyses have been used to describe the recurrence intervals of flood pulses in this study. Of note, all the analyses clearly show that the peak Michigan Bar flow for 1997, which was reported at 93,000 cfs, significantly exceeded a 100 year event and the two most recent analyses (PWA and David Ford) have the 1997 event exceeding a 200 year event. Table E-3 shows the peak flows for different return intervals for Michagan Bar from the various analyses.

Table E-3. Comparison of peak flow (cfs) at Michigan Bar

	Return Period (Year)					
	10	25	50	100	200	500
USGS	34,200		66,800	82,900		125,000
PWA	30,548			68,000	79,900	
David Ford	40,846	53,865	60,400	73,022	82,340	

Index Points

In addition to utilizing gage data as boundary conditions for the simulated hydraulic system, gage data from locations within the model domain, including Benson's Ferry and New Hope Landing, were used to calibrate and validate the model results. Figure E- 5 shows the index points that were used in the model to interpret and compare results for different Project Alternatives.

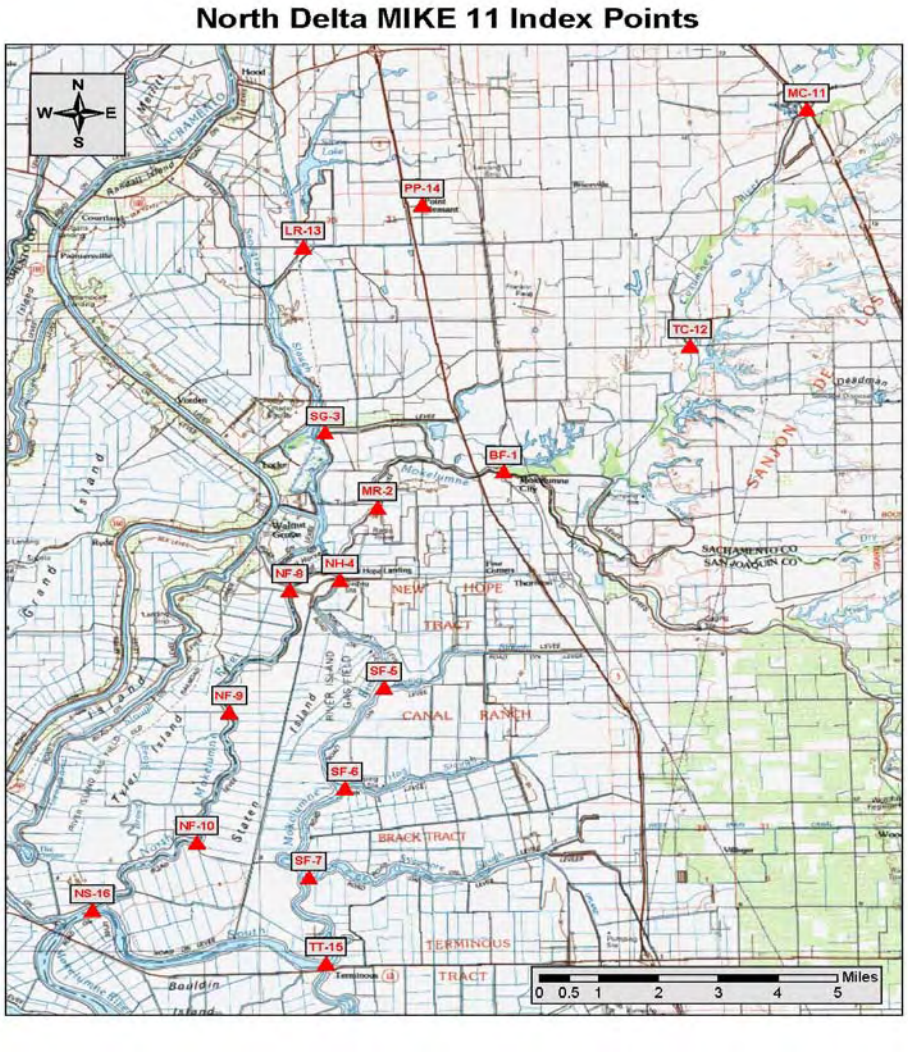


Figure E-5. North Delta MIKE11 Index Points

Model Limitations

One-Dimensional Model

It is also important to understand the simplifications and assumptions which are often made when applying a model and evaluating a physical system. The MIKE 11 hydraulic model used for the North Delta Project area is hydraulic not hydrologic. Hydrologic elements of river and floodplain systems, which are not incorporated, include the groundwater-surface water interaction, as well as surface water interaction with the atmosphere and vegetation. Water movement is simulated based upon water forces, and assumed to act only in the longitudinal direction. Thus effects from an eddy or a rapid, formed by a constriction in the

river channel or at a levee breach are not captured in this model (or in any one dimensional hydrodynamic model).

Cross Sections and Boundary Conditions

A great deal of real data have been utilized in compiling, calibrating, and validating the model. However, many crucial data elements including cross sectional geometry, boundary conditions, and system connectivity are not available, and hence, have been estimated. Other uncertainties arise when using cross sectional data, which were measured at different times with different methods. For example, data from as early as 1934 were used in the model. Yet another element of uncertainty is the lack of channel cross sectional data in some reaches, with 2.1 miles between cross sections in some cases.

Estimation of certain boundary condition data was necessary. Boundary condition estimation was required for Deer Creek at Wilton Road, Dry Creek above Galt, Stone Lakes Outfall at Lambert Road, and Little Potato Slough below Terminous Tract, for various time periods of the 1986, 1997, 1998, 1999, and 2000 storm events.

Dry Creek Flow

The Dry Creek watershed is known to contribute significant flows to the North Delta Project area during storms. Gage data at the Dry Creek Galt gage is available for limited periods. Data for the gage during the 1986 storm is available, but in order to simulate the years of 1997, 1998, 1999, and 2000 an estimation of the Dry Creek flow contribution was required. A comparison of daily average discharge values in 1986 suggests that during storm events, the Dry Creek at Galt discharge is roughly 40% of Cosumnes River discharge at Michigan Bar. Based upon this comparison of historic discharge data the Dry Creek at Galt boundary condition were estimated for the 1998, 1999, and 2000 model runs to be 40% of the discharge of the Cosumnes River at Michigan Bar (USACE 1990). However, 30% of the Michigan Bar discharge was used for the 1997 run. A limitation to this approach is that it overestimates Dry Creek discharge during low flow conditions, and may underestimate Dry Creek discharge during flood pulses.

Stage Data

Data from the stage gages located at Wilton Road on Deer Creek and Lambert Road at the Stone Lakes Outfall, both operated by SAFCA, do not exist for 1986. For the Wilton Road gage, a correlation to an adjacent gaging station for which data were available was not attempted. Instead, an average low flow water elevation of 53.8 feet was assumed. This value was chosen by inspection of available data for the period of 1998-2000. No attempt was made to synthesize

flood pulse water levels. At the Stone Lakes Outfall at Lambert Road, a control structure prevents water from flowing south to north at this location. For a brief period during the large flood of 1986, flow traveled over Lambert Road north into the Stone Lakes Region (USACE 1988). For 1986 model simulations a weir was inserted at Lambert Road, which prevented flow during non-flood conditions, but allowed some water to travel north over Lambert Road during the peak of the flood pulse (Hammersmark 2002).

Calibration Methodology

The high degree of uncertainty in various model inputs such as channel geometry, assumed boundary conditions, and system connectivity, made calibration and verification of the model a complex undertaking. The model improvement and calibration proceeded in two phases, focusing on different flow conditions. Initially, the low flow, tidally dominated portion of the hydrograph was considered, and adjustments were made so that the model would accurately reflect the amplitude and timing of observed tidal signal data.

The second phase of model calibration focused on improving the timing, magnitude and hydrograph shape of various flood pulses. This involved refining the connectivity of the simulated hydraulic system to result in the best agreement with observed data. In particular, the manner in which the Cosumnes River channel flow accesses (through overtopping, breaching, etc.) floodplain regions, and the effect of such regions on attenuating flood pulses was refined. (Hammersmark 2002)

Comparison to Observed Data

Ultimately, the North Delta MIKE 11 model was applied to simulate the flooding period of the following five years: 1986, 1997, 1998, 1999, and 2000. Calibration plots (shown in Figures E-6 through E-10) illustrate that the model is in good agreement with the observed data for the range of storm events. They include tidal influence and floods of various magnitudes, including two large storm events (1986 and 1997). Deviations in some of the peaks are most likely the result of the use of a constant percentage of Michigan Bar flows applied for Dry Creek. There was no apparent basis to manipulate the Dry Creek flows for year to year to better represent the flow ranges. The observed agreement of the model results with the measured data ensured that it could be confidently used for the comparative evaluation of flood control and ecosystem restoration Alternatives.

One additional method of evaluating the model results for the 1986 flooding event was a comparison of maximum floodwater volume stored in the various areas flooded as levees failed. Maximum floodwater storage in McCormack-Williamson Tract, Glanville Tract, Dead Horse Island, Tyler Island, and New Hope Tract were estimated by the Sacramento District of the U. S. Army Corp of

Engineers (1988). Table E-4 presents the values that support a reasonable agreement between the estimate and the model.

Table E-4. Comparison of Model Simulation Results to Estimated Values of Maximum Floodwater Storage for Each Flooded Island or Tract During the 1986 Flood Event

	Maximum Floodwater Storage (ac-ft)	
Flooded Region	Simulation	Estimated [1]
Glanville Tract	48,900	45,000
M-W Tract	18,900	17,000 – 20,000
Dead Horse Island	2,700	2,000 – 3,000
Tyler Island	108,000	130,000 -150,000
New Hope Tract	49,300	60,000

Note:

[1] Estimated maximum floodwater storage values obtained from U. S. Army Corps of Engineers, 1988.

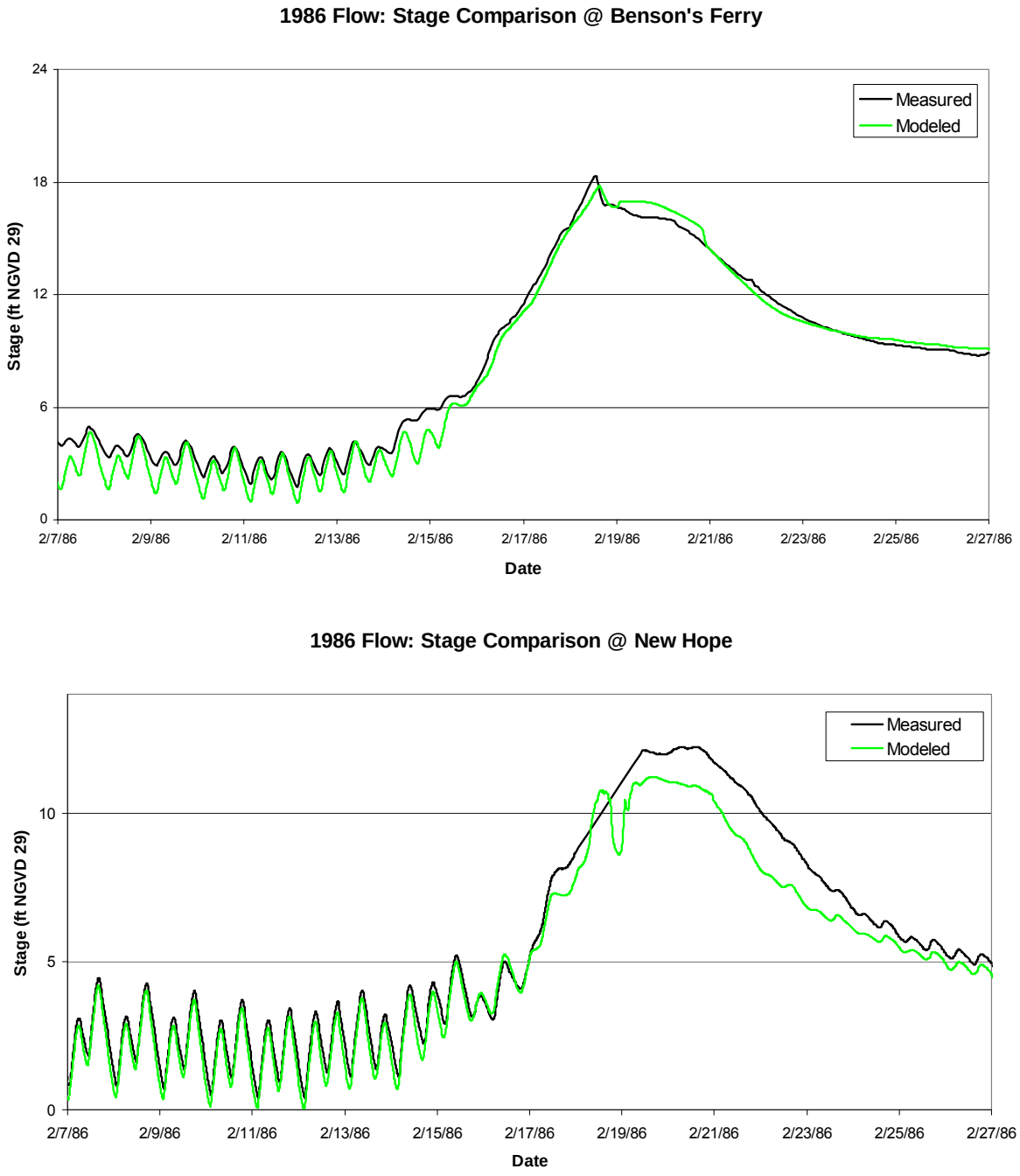


Figure E-6. Model results Compared to Measured Data at Benson's Ferry (top panel) and New Hope (bottom panel) for the Year 1986 Flow

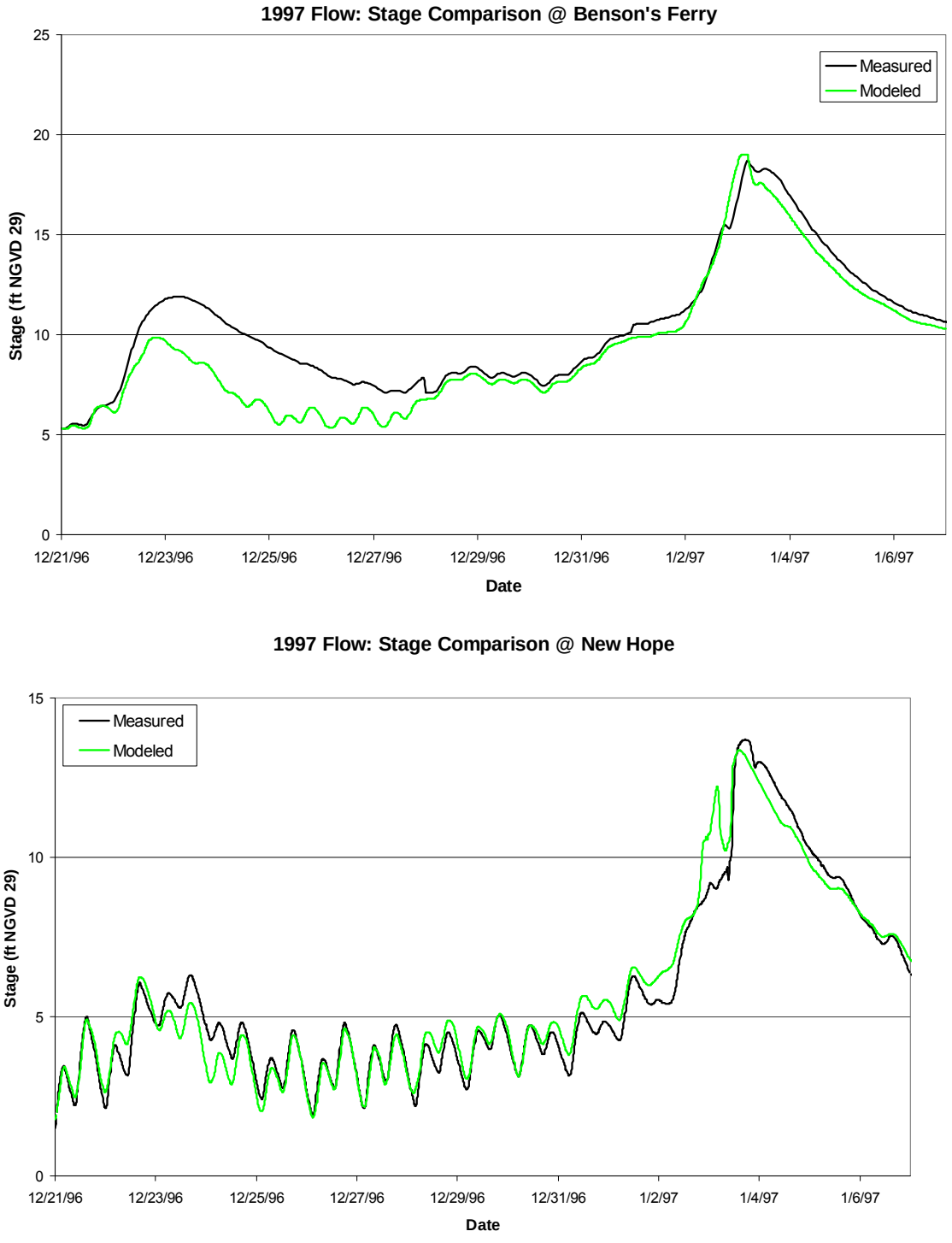


Figure E-7. Model Results Compared to Measured Data at Benson's Ferry (top panel) and New Hope (bottom panel) for the Year 1997 Flow.

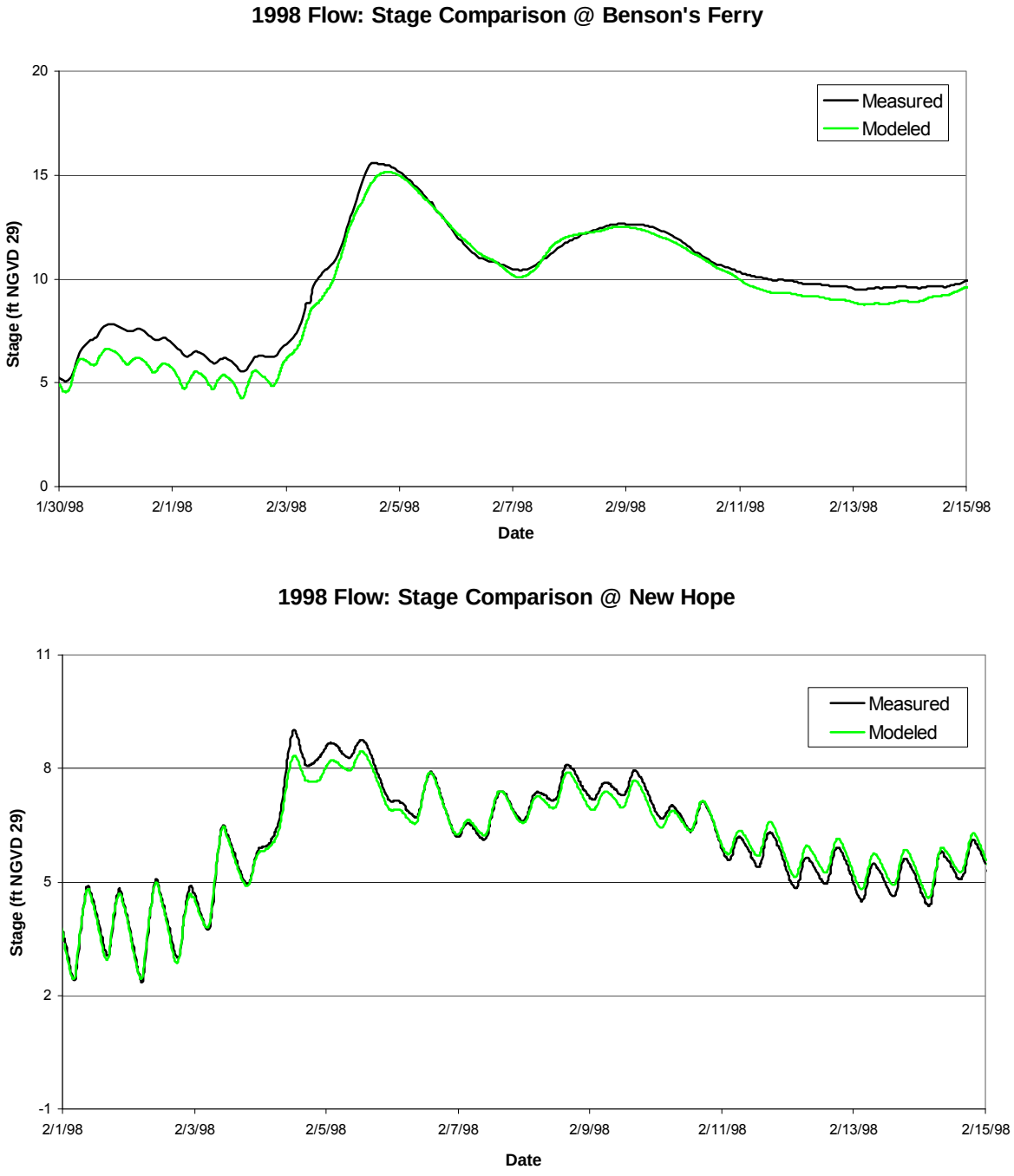


Figure E-8. Model Results Compared to Measured Data at Benson's Ferry (top panel) and New Hope (bottom panel) for the Year 1998 Flow

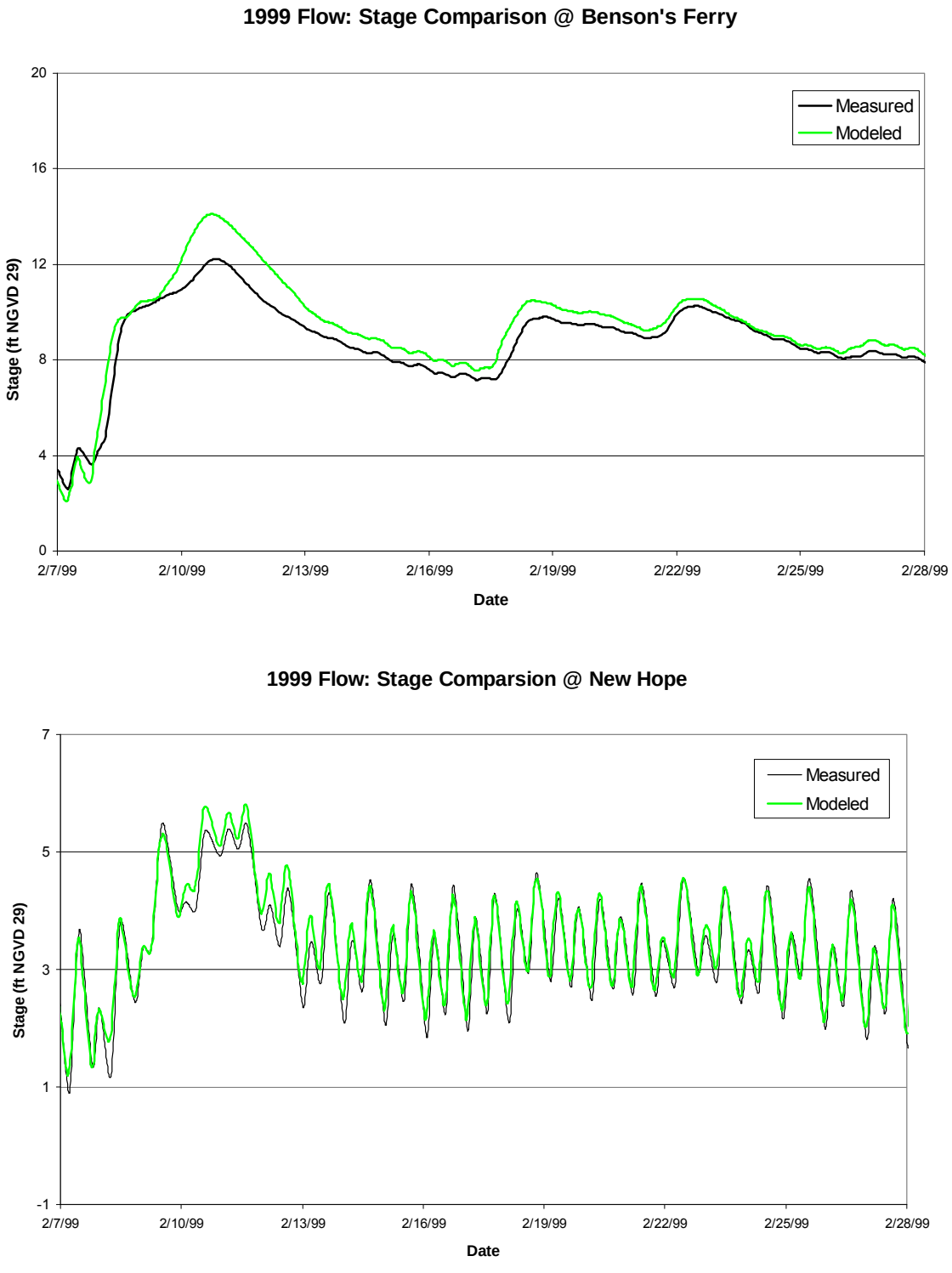


Figure E-9. Model Results Compared to Measured Data at Benson's Ferry (top panel) and New Hope (bottom panel) for the Year 1999 Flow

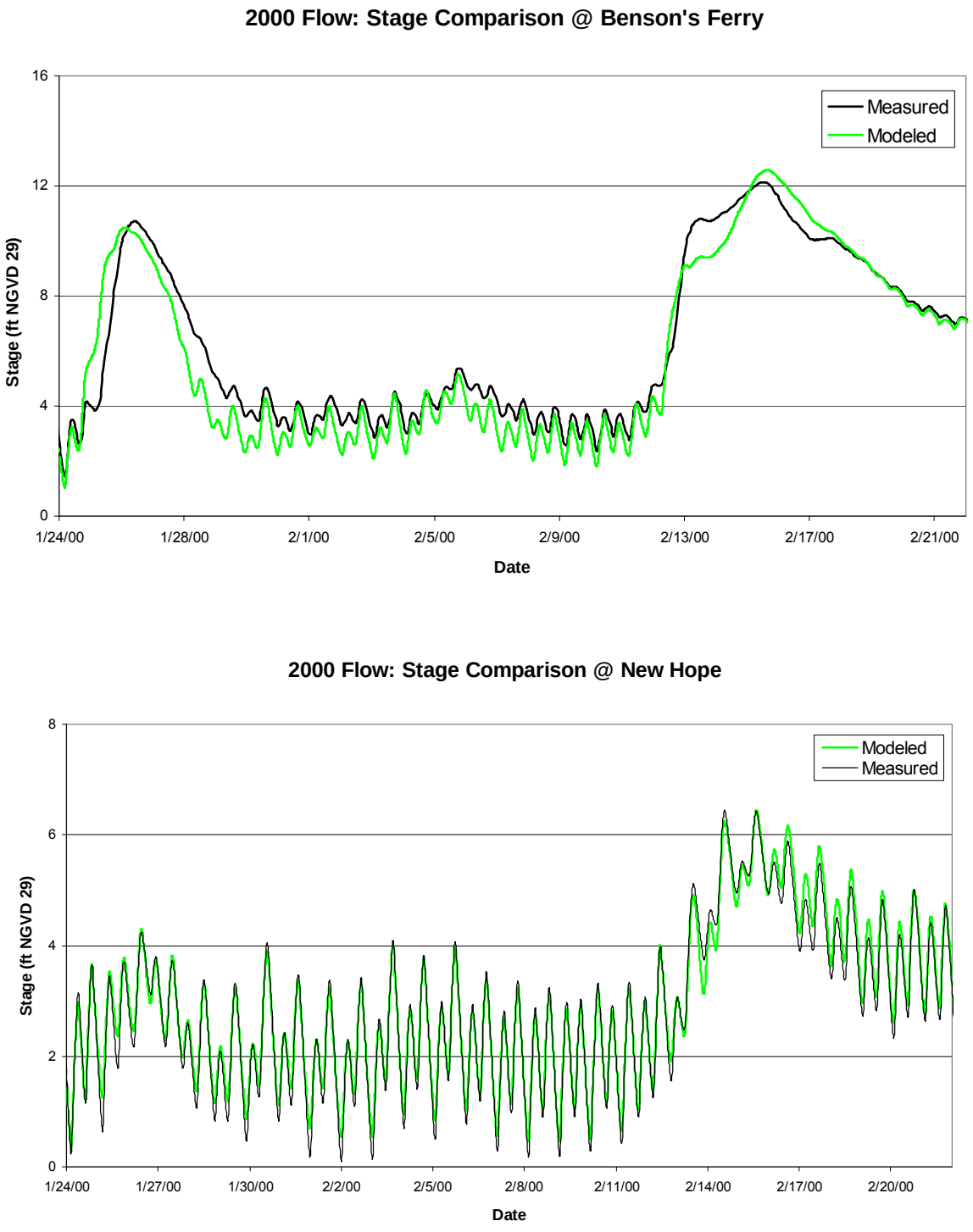


Figure E-10. Model Results Compared to Measured Data at Benson's Ferry (top panel) and New Hope (bottom panel) for the Year 2000 Flow

Sensitivity Analysis

To determine the sensitivity of the model's results to various input parameters, sensitivity runs were performed. In conducting a sensitivity analysis, one input parameter was adjusted while all other parameters were left unchanged. The model sensitivity to three types of input parameters were investigated:

- The timing and magnitude of upstream discharge (Cosumnes River at Michigan Bar, Dry Creek above Galt, Mokelumne River at Woodbridge and the Sacramento River at Georgiana Slough),
- Downstream water level (Mokelumne River at Georgiana Slough and Little Potato Slough near Terminous Tract), and
- Channel roughness.

The first four months of flow in 1998 (1/3/98 to 4/30/98) were chosen for the sensitivity analysis, to allow for the analysis of tidally dominated/low river flow conditions in addition to flood events of varying magnitude (up to ~10 year return interval at Michigan Bar). The sensitivity analysis indicated that the model was sensitive to alterations of most input parameters, with varying degrees of sensitivity observed at Benson's Ferry and New Hope Landing.

Levee Failure Criteria

Levee failures have a significant influence upon water levels in the North Delta. Many levee failures occurred during the floods of 1986 and 1997, which impacted the water surface elevations in the channels and inundated adjacent lands. Reasonably good data exists for the levee failures that occurred during the 1986 and 1997 floods. Therefore, it was possible to calibrate the model for these events. Historic levee breaks from these floods were triggered in the model by water surface elevation. Breach dimensions were estimated based on the data available. However, further consideration was required regarding the potential for other levee failures when the system was modified to simulate Alternatives.

Regardless of the methods used to develop levee failure criteria, there was much uncertainty when predicting a levee failure due to high water levels. The Department of Water Resources, in coordination with the North Delta Improvements Group, adopted systematic levee failure criteria for the North Delta MIKE11 model. Levee failure criteria were developed for river reaches west of Interstate 5 based on existing North Delta area breach data. Due to lack of topographic data in many areas on the upper and lower Cosumnes River east of I-5, historic breaks were simulated along these reaches in the model for all model 1997 runs. Because the magnitude of the 1997 event was large and the levees along the Cosumnes are very low and expected to overtop in large events, this was deemed a reasonable assumption.

Lateral flow due to levee overtopping allows for exchange of flow between floodplain conveyance and the river channel. Floodwater enter the overbank areas by overtopping and breaching the levee structure. The rate of levee overflow was computed by the broad-crested weir relationship. The model has the capability to compute flow through breached levees. Input parameters were the failure mode, final bottom width, final bottom elevation, left slope, right slope, and final formation time.

Breach locations were identified by determining the point on each river reach where the distance from the top of the levee (from topographic data) and the maximum water surface elevation (from 1997 base condition MIKE11 runs) was minimum. The failure mode was by overtopping. The final breach dimensions and other parameters are as follows:

- Final bottom width: 500 feet (recommendation from General Characterization of Unplanned Levee Breach Geometries – DWR)
- Breach depth: 40 feet (recommendation from General Characterization of Unplanned Levee Breach Geometries – DWR)
- Final bottom elevation: Existing ground surface elevation on landside of levee
- Left slope: 1
- Right slope: 1
- Model breach as a broad crested weir with weir coefficient of 2.6 (coefficient varies between 2.6 and 3.1 depending on levee cross sectional characteristics – Skogerboe and Hyatt, 1967)
- Rate of breach formation: 1 ft/hr (Powledge et al. 1989)

Flood Control and Ecosystem Restoration Alternatives Modeling

Hydraulic modeling of the North Delta area over a wide range of flows was performed to characterize the current system hydraulically, and to comparatively evaluate the potential impacts of flood control and ecosystem restoration Project Alternatives. The following list includes the hydrologic events and simulation periods for the modeling results presented in this section.

Table E-5. Simulation period and return interval of hydrology

Year	Simulation Period	Return Interval[1]
2000	1/3/2000 till 4/30/2000	~2.5
1999	1/3/1999 till 4/30/1999	~5
1998	1/3/1998 till 4/30/1998	~10
1986	1/3/1986 till 4/30/1986	~25
1997	12/3/1996 till 1/15/1997	200+

[1] Return interval for annual peak flow at Michigan Bar gage on Cosumnes River.

Comparative Simulations for Alternatives

Simulations of Project Alternatives were performed for the flood events listed in Table E-5 and for a 100-yr flood event. Early modeling runs established that there were no appreciable differences between the various flood control and ecosystem restoration configurations on McCormack-Williamson Tract (Group 1 Actions as described in Chapter 2) with regard to system-wide flood performance. This is because all the scenarios on McCormack-Williamson Tract include lowering the East levee to 8.5 ft (NGVD 29) which is the greatest significant flood performance control in the area. Therefore, the Group 2 Alternatives were run with Ecosystem option #2 (i.e., Alternative 1-B) only, and this was taken as representative of performance of any of the McCormack-Williamson Tract Group 1 options in combination with the modeled Group 2 component.

For the purpose of displaying the modeling results in this Appendix, the following naming conventions are used in the Tables and Figures herein. Detailed descriptions of the components of each Alternative are provided in Chapter 2 of the EIR.

- Eco-Scenario #2 = Alternative 1-B or Seasonal Floodplain Optimization
- Flood Option #1 = Alternative 2-A or North Staten Detention
- Flood Option #2 = Alternative 2-B or West Staten Detention
- Flood Option #3 = Alternative 2-C or East Staten Detention
- Flood Option #4 = Alternative 2-D or Dredge and Levee Modifications

The results of the flood control modeling are presented in several ways. The maximum stage at each of the model index points for each of the runs are shown in Table E-6 for 1986 hydrology, Table E-7 for the 1997 hydrology, and Table E-8 for the 100-yr flood hydrology. Stage hydrographs are shown in Figures E-11 through E-30 at representative points including New Hope, Benson's Ferry, and downstream locations on the North and South Forks of the Mokelumne for the

1997 hydrology. The plots are focused in the time windows where noticeable changes were observed. These provide a comparison of stage duration with and without the Project Alternative. A full set of stage hydrographs at each index point for each modeled hydrology can be made available on CD by request.

Table E-9 provides a comparison of maximum velocities at key points for each of the flood control Alternatives (combined with Alternative 1-B, ecological option 2) for 1986 and 1997 hydrology. Figures E-31 and E-32 show flow splits for the North and South Forks of the Mokelumne River for each of the Alternatives for 1986 and 1997 hydrology. South Fork and North fork flows were estimated at approximately 2 miles downstream from the New Hope Bridge and Miller Ferry Bridge, respectively. The flow-split comparisons are intended to provide a rough qualitative idea of how flow-splits may change for each of the Project Alternatives. Of note, because of the complexity of the hydraulic system, the flow splits should be considered in context with the respective stage hydrographs, detention basin volumes, and other flows throughout the system. For example, there is not necessarily a direct correlation between volumes captured in Staten detention basins and instantaneous flow remaining in the North and South Forks.

Table E-6. Comparison of Group 2 Project Alternatives: Water Level Impacts for 1986 Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)						
					Group 2 Alternatives, Combined with Alternative 1-B			
		1986 Flood	1986 No Failures	Alternative 1-B (Base Case)	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
BF-1	Benson's Ferry	17.8	18.8	16.3 (2.5)[1]	15.6 (3.2)	15.8 (3.0)	15.8 (3.0)	15.5 (3.3)
MR-2	Mokelumne River	14.4	15.6	13.6 (2.0)	11.6 (4.0)	12.5 (3.1)	12.6 (3.0)	12.1 (3.5)
SG-3	Snodgrass Slough	12.9	15.0	14.3 (0.7)	12.7 (2.3)	13.4 (1.6)	13.5 (1.5)	13.0 (2.0)
NH-4	New Hope	12.5	13.3	13.3 (0)	11.0 (2.3)	12.1 (1.2)	12.2 (1.1)	12.0 (1.3)
SF-5	SF[2] Mokelumne	8.7	9.4	9.3 (0.1)	8.2 (1.2)	8.7 (0.7)	8.3 (1.1)	9.1 (0.3)
SF-6	SF Mokelumne	7.2	7.6	7.6 (0)	7.2 (0.4)	7.3 (0.3)	7.2 (0.4)	7.9 (-0.3)
SF-7	SF Mokelumne	6.9	7.3	7.3 (0)	7.0 (0.3)	7.1 (0.2)	7.0 (0.3)	7.4 (-0.1)
NF-8	NF Mokelumne	11.3	12.5	12.7 (-0.2)	10.8 (1.7)	11.2 (1.3)	11.7 (0.8)	11.5 (1.0)
NF-9	NF Mokelumne	8.4	9.6	9.7 (-0.1)	8.6 (1.0)	8.8 (0.8)	9.1 (0.5)	9.0 (0.6)
NF-10	NF Mokelumne	6.9	7.9	7.9 (0)	7.4 (0.5)	7.5 (0.4)	7.6 (0.3)	7.7 (0.2)
MC-11	McConnell	46.3	46.3	46.3 (0)	46.2 (0.1)	46.2 (0.1)	46.2 (0.1)	46.3 (0)
TC-12	Twin Cities Road	24.9	24.9	24.7 (0.2)	24.6 (0.3)	24.6 (0.3)	24.6 (0.3)	24.7 (0.2)
LR-13	Lambert Road	12.9	15.0	14.3 (0.7)	12.7 (2.3)	13.4 (1.6)	13.5 (1.5)	13.0 (2.0)

Index Point	Location	Peak Stage (ft NGVD 29)						
					Group 2 Alternatives, Combined with Alternative 1-B			
		1986 Flood	1986 No Failures	Alternative 1-B (Base Case)	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
PP-14	Point Pleasant	13.5	13.9	13.5 (0.4)	11.2 (2.7)	13.4 (0.5)	13.4 (0.5)	13.4 (0.5)
TT-15	Terminous Tract	6.8	7.1	7.2 (-0.1)	6.9 (0.2)	7.0 (0.1)	7.0 (0.1)	7.2 (-0.1)
NS-16	Confluence of NF and SF	6.8	7.2	7.2 (0)	7.0 (0.2)	7.0 (0.2)	7.0 (0.2)	7.2 (0)
Detention basin volume (ac-ft)					48,300[3]	35,600[4]	32,400[4]	N/A

[1] Value in parentheses denotes: stage difference (ft) = Stage for "No Failure" – Stage for "Alternative";

Positive value denotes stage drop.

[2] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

[3] 10-ft weir height

[4] 9-ft weir height

Table E-7. Comparison of Group 2 Project Alternatives: Water Level Impacts for 1997 Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)						
					Group 2 Alternatives, Combined with Alternative 1-B			
		1997 Flood	1997 No Failures	Alternative 1-B (Base Case)	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
BF-1	Benson's Ferry	19.2	19.9	17.4 (2.5)[1]	16.8 (3.1)	17.2 (2.7)	17.1 (2.8)	16.6 (3.3)
MR-2	Mokelumne River	16.1	16.9	14.6 (2.3)	12.1 (4.8)	13.3 (3.6)	13.6 (3.3)	12.9 (4.0)
SG-3	Snodgrass Slough	15.0	16.3	15.4 (0.9)	13.9 (2.4)	14.4 (1.9)	14.7 (1.6)	13.8 (2.5)
NH-4	New Hope	14.3	14.5	14.3 (0.2)	11.4 (3.1)	12.7 (1.8)	13.1 (1.4)	12.8 (1.7)
SF-5	SF[2] Mokelumne	9.6	9.7	9.7 (0)	7.9 (1.8)	8.7 (1.0)	8.2 (1.5)	9.3 (0.4)
SF-6	SF Mokelumne	7.2	8.3	7.2 (1.1)	6.4 (1.9)	6.7 (1.6)	6.6 (1.7)	7.6 (0.7)
SF-7	SF Mokelumne	6.7	6.8	6.7 (0.1)	6.2 (0.6)	6.4 (0.4)	6.3 (0.5)	6.9 (-0.1)
NF-8	NF Mokelumne	13.4	13.6	13.6 (0)	11.1 (2.5)	11.5 (2.1)	12.7 (0.9)	12.2 (1.4)
NF-9	NF Mokelumne	9.9	10.0	10.1 (-0.1)	8.4 (1.6)	8.8 (1.2)	9.4 (0.6)	9.2 (0.8)
NF-10	NF Mokelumne	7.7	7.8	7.8 (0)	6.9 (0.9)	7.1 (0.7)	7.4 (0.4)	7.4 (0.4)
MC-11	McConnell	49.8	49.8	49.8 (0)	49.7 (0.1)	49.7 (0.1)	49.7 (0.1)	49.8 (0)
TC-12	Twin Cities Road	25.8	25.8	25.6 (0.2)	25.6 (0.2)	25.6 (0.2)	25.6 (0.2)	25.6 (0.2)
LR-13	Lambert Road	15.0	16.3	15.4 (0.9)	13.9 (2.4)	14.4 (1.9)	14.7 (1.6)	13.8 (2.5)

Index Point	Location	Peak Stage (ft NGVD 29)						
					Group 2 Alternatives, Combined with Alternative 1-B			
		1997 Flood	1997 No Failures	Alternative 1-B (Base Case)	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
PP-14	Point Pleasant	12.5	12.7	12.5 (0.2)	12.3 (0.4)	12.4 (0.3)	12.5 (0.2)	12.5 (0.2)
TT-15	Terminous Tract	6.5	6.5	6.5 (0)	6.0 (0.5)	6.2 (0.3)	6.2 (0.3)	6.6 (-0.1)
NS-16	Confluence of NF and SF	6.7	6.7	6.7 (0)	6.3 (0.4)	6.4 (0.3)	6.5 (0.2)	6.6 (0.1)
Detention basin volume (ac-ft)					36,900[3]	24,800[4]	21,200[4]	N/A

[1] Value in parentheses denotes: stage difference (ft) = Stage for "No Failure" – Stage for "Alternative";
Positive value means stage drop.

[2] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

[3] 10-ft weir height

[4] 9-ft weir height

Table E-8. Comparison of Group 2 Project Alternatives: Water Level Impacts for 100-Yr Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)					
				Group 2 Alternatives, Combined with Alternative 1-B			
		100-year No Failures	Alternative 1-B (Base Case)	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
BF-1	Benson's Ferry	18.7	16.1 (2.6)[1]	15.9 (2.8)	16.0 (2.7)	16.0 (2.7)	15.7 (3.0)
MR-2	Mokelumne River	15.3	13.0 (2.3)	12.0 (3.3)	12.5 (2.8)	12.6 (2.7)	11.8 (3.5)
SG-3	Snodgrass Slough	14.6	13.8 (0.8)	11.5 (3.1)	13.4 (1.2)	13.5 (1.1)	12.2 (2.4)
NH-4	New Hope	12.9	12.8 (0.1)	11.5 (1.4)	12.2 (0.7)	12.3 (0.6)	11.7 (1.2)
SF-5	SF[2] Mokelumne	8.7	8.5 (0.2)	7.9 (0.8)	8.2 (0.5)	8.1 (0.6)	8.5 (0.2)
SF-6	SF Mokelumne	6.9	6.9 (0)	6.7 (0.2)	6.8 (0.1)	6.8 (0.1)	7.2 (-0.3)
SF-7	SF Mokelumne	6.7	6.7 (0)	6.5 (0.2)	6.6 (0.1)	6.6 (0.1)	6.8 (-0.1)
NF-8	NF Mokelumne	12.1	12.1 (0)	11.2 (0.9)	11.2 (0.9)	11.7 (0.4)	11.2 (0.9)
NF-9	NF Mokelumne	8.9	8.8 (0.1)	8.4 (0.5)	8.5 (0.4)	8.6 (0.3)	8.4 (0.5)
NF-10	NF Mokelumne	7.3	7.3 (0)	7.2 (0.1)	7.3 (0)	7.3 (0)	7.1 (0.2)
MC-11	McConnell	48.0	48.0 (0)	48.0 (0)	48.0 (0)	48.0 (0)	48.0 (0)
TC-12	Twin Cities Road	25.5	25.4 (0.1)	25.4 (0.1)	25.4 (0.1)	25.4 (0.1)	25.4 (0.1)
LR-13	Lambert Road	14.6	13.8 (0.8)	13.1 (1.5)	13.4 (1.2)	13.5 (1.1)	12.5 (2.1)
PP-14	Point Pleasant	11.9	11.8 (0.1)	11.8 (0.1)	11.8 (0.1)	11.8 (0.1)	11.7 (0.2)
TT-15	Terminous Tract	6.5	6.5 (0)	6.4 (0.1)	6.5 (0)	6.5 (0)	6.6 (-0.1)
NS-16	Confluence of NF and SF	6.8	6.8 (0)	6.7 (0.1)	6.7 (0.1)	6.7 (0.1)	6.7 (0.1)
Detention basin volume (ac-ft)				23,400[3]	16,000[4]	16,100[4]	N/A

[1] Value in parentheses denotes: stage difference (ft) = Stage for "No Failure" – Stage for "Alternative";
Positive value denotes stage drop.

[2] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

[3] 10-ft weir height

[4] 9-ft weir height

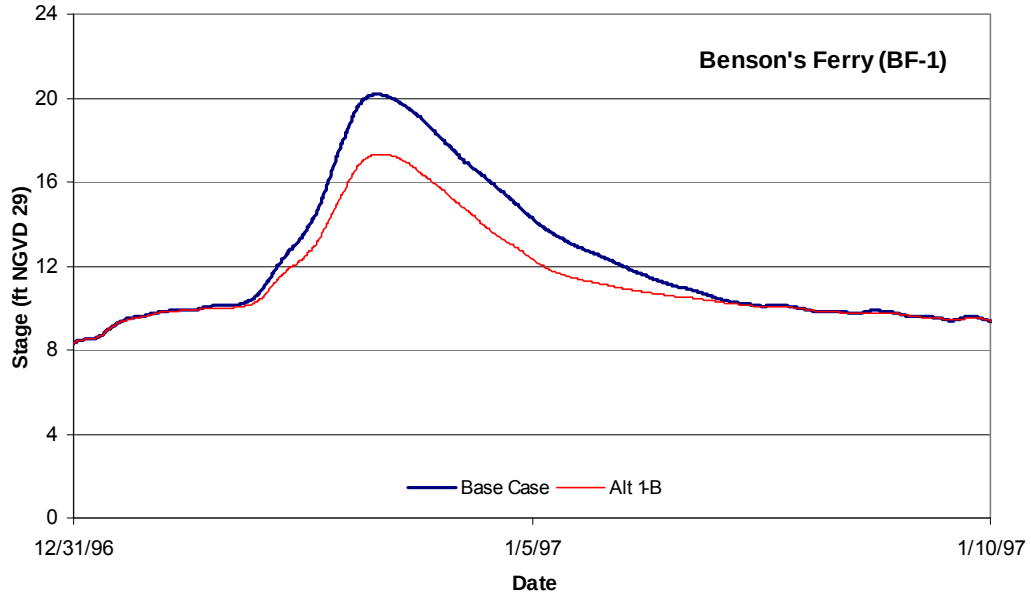


Figure E-11. Model Results at Benson's Ferry for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 1-B and the Base Case (Alternative NP).

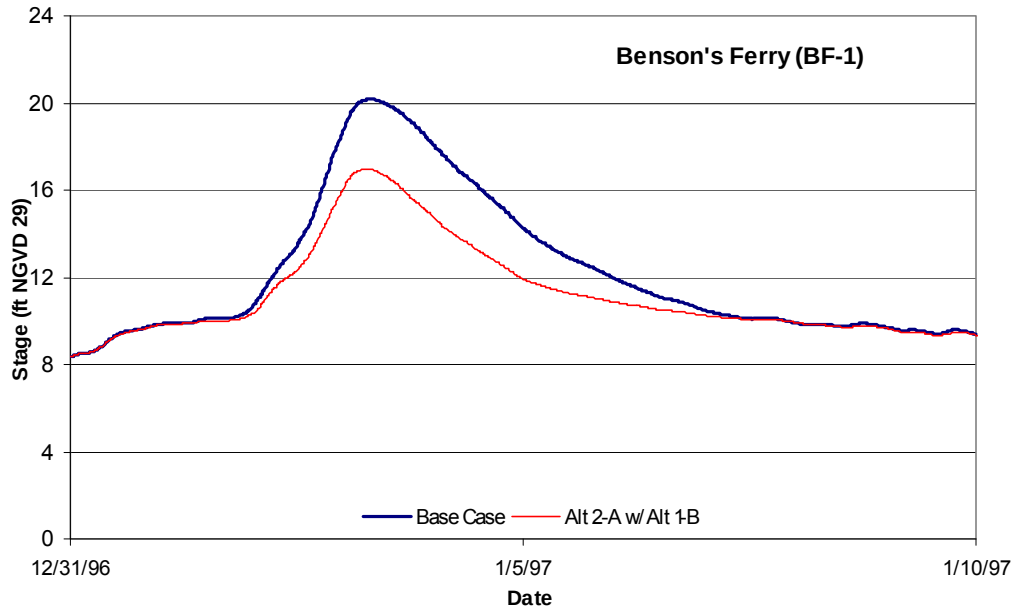


Figure E-12. Model Results at Benson's Ferry for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-A w/ 1-B and the Base Case (Alternative NP).

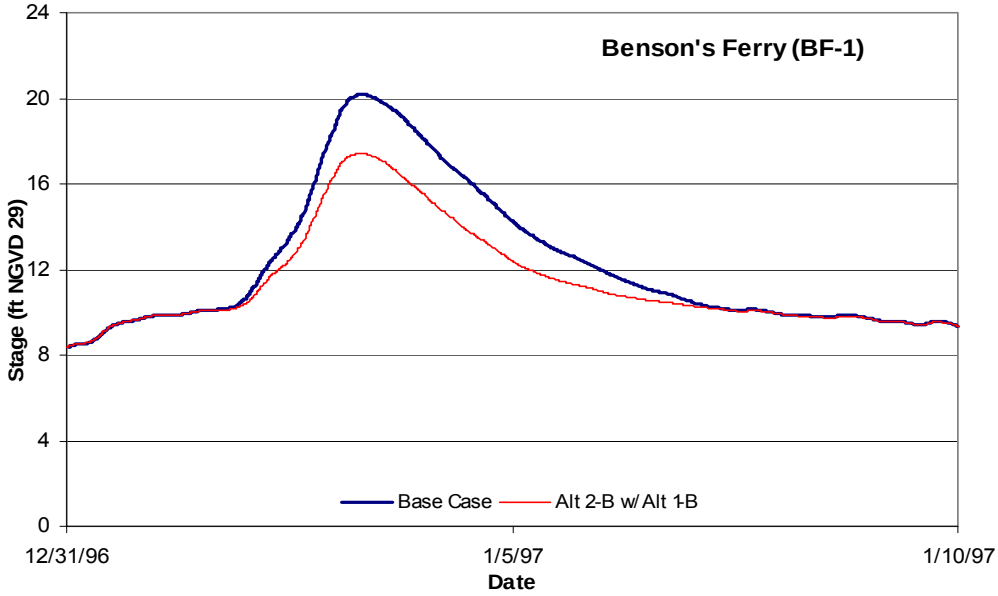


Figure E-13. Model Results at Benson's Ferry for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-B w/ 1-B and the Base Case (Alternative NP).

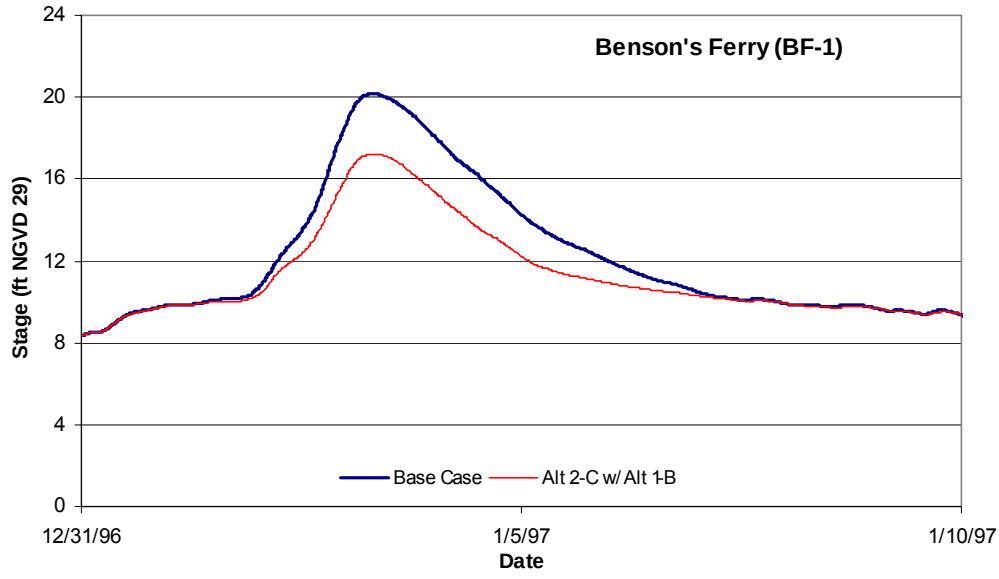


Figure E-14. Model Results at Benson's Ferry for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-C w/ 1-B and the Base Case (Alternative NP).

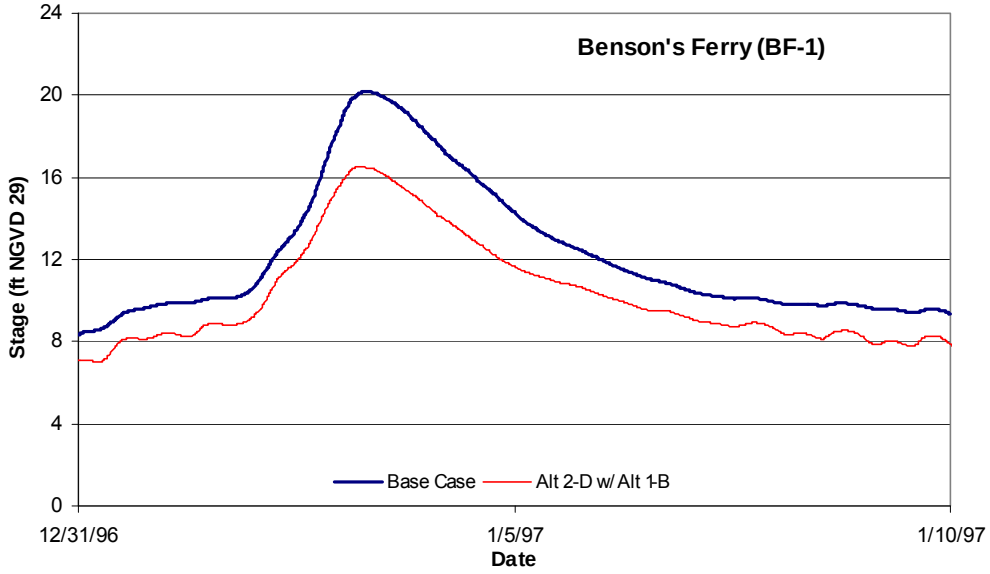


Figure E-15. Model Results at Benson's Ferry for the 1997 Flood Hydrology (with no levee failure): Comparison between Alternative 2-D w/ 1-B and the Base Case (Alternative NP).

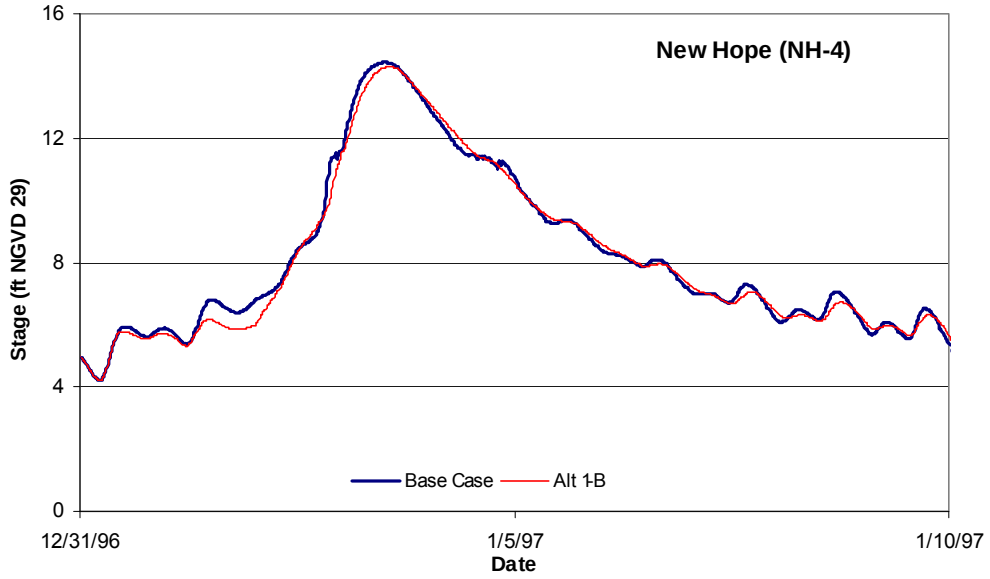


Figure E-16. Model Results at New Hope for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 1-B and the Base Case (Alternative NP).

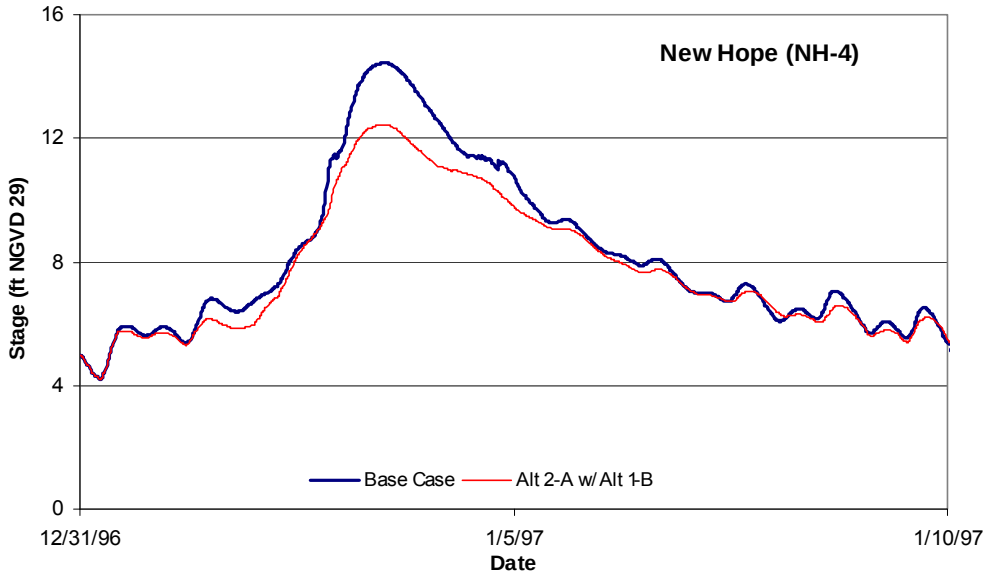


Figure E-17. Model Results at New Hope for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-A w/ 1-B and the Base Case (Alternative NP).

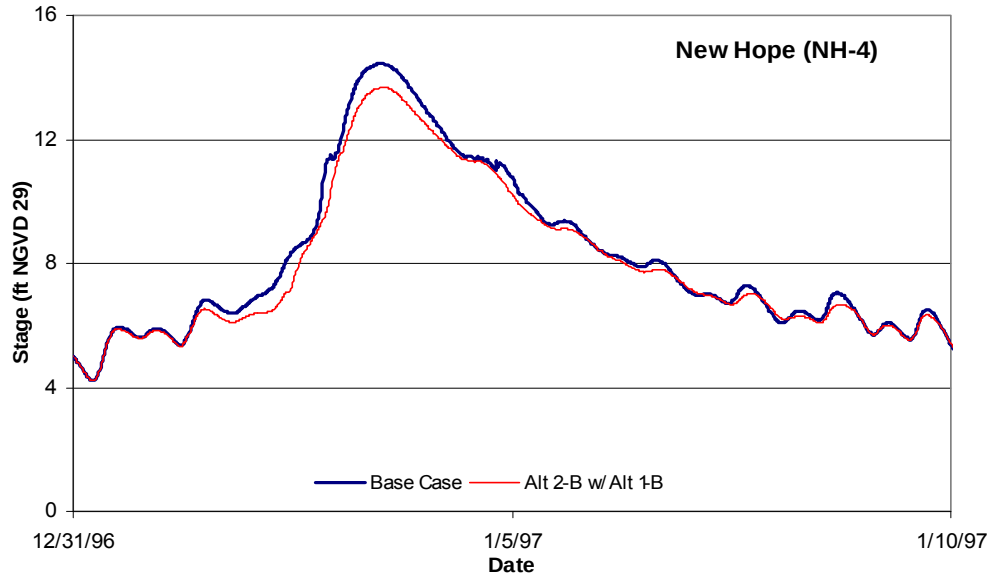


Figure E-18. Model Results at New Hope for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-B w/ 1-B and the Base Case (Alternative NP).

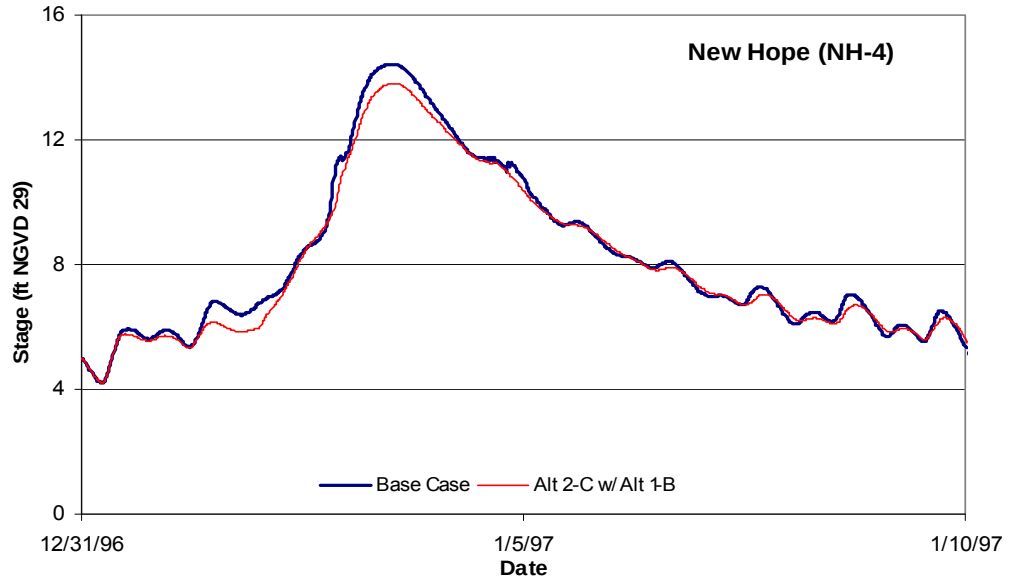


Figure E-19. Model Results at New Hope for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-C w/ 1-B and the Base Case (Alternative NP).

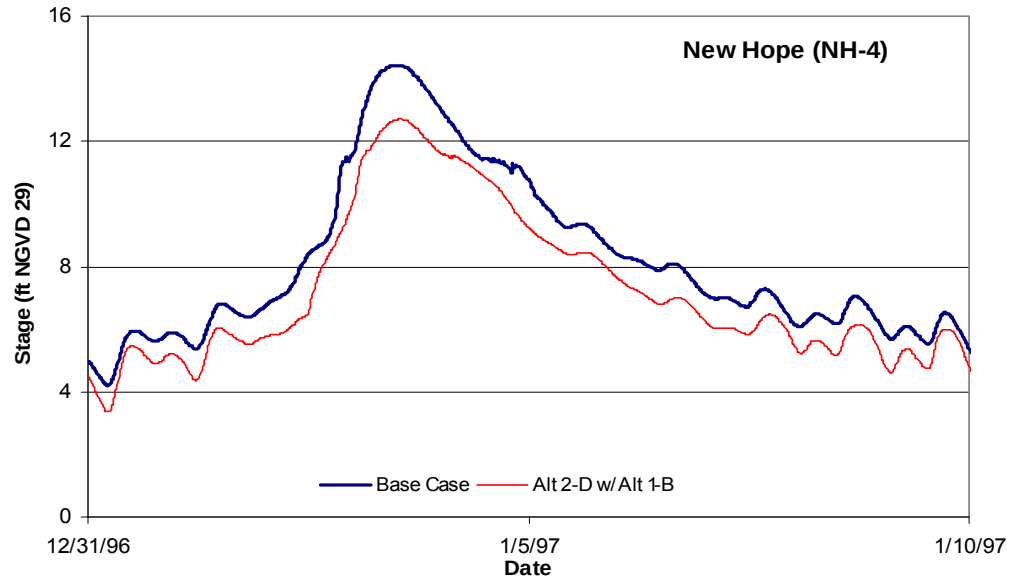


Figure E-20. Model Results at New Hope for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-D w/ 1-B and the Base Case (Alternative NP).

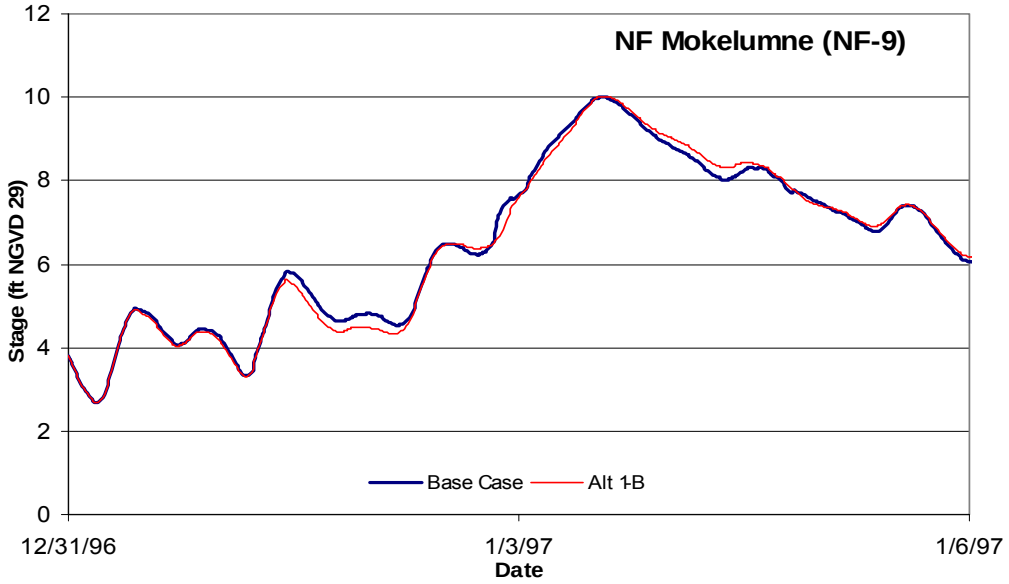


Figure E-21. Model Results at NF-9 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 1-B and the Base Case (Alternative NP).

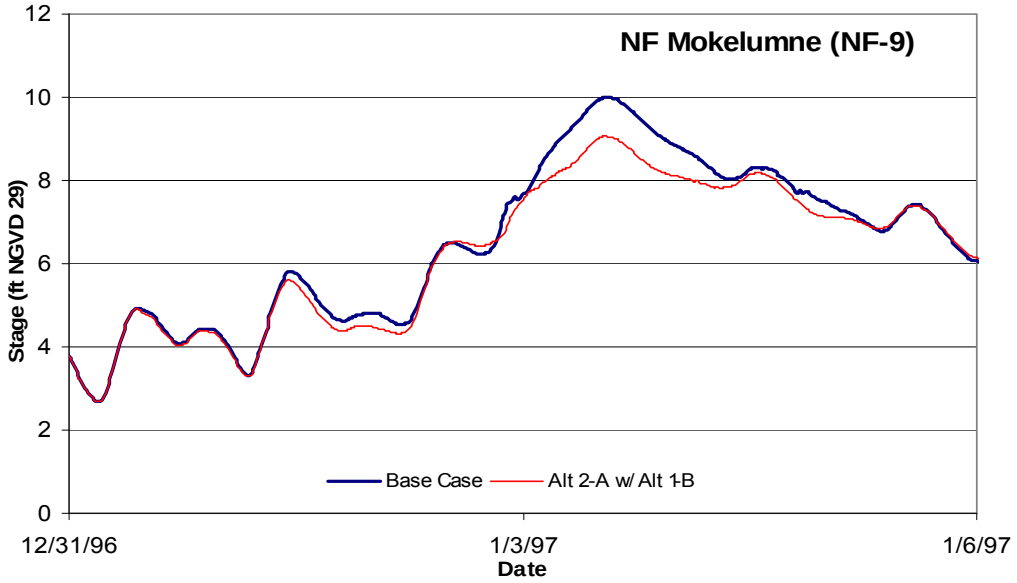


Figure E-22. Model Results at NF-9 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-A w/ 1-B and the Base Case (Alternative NP).

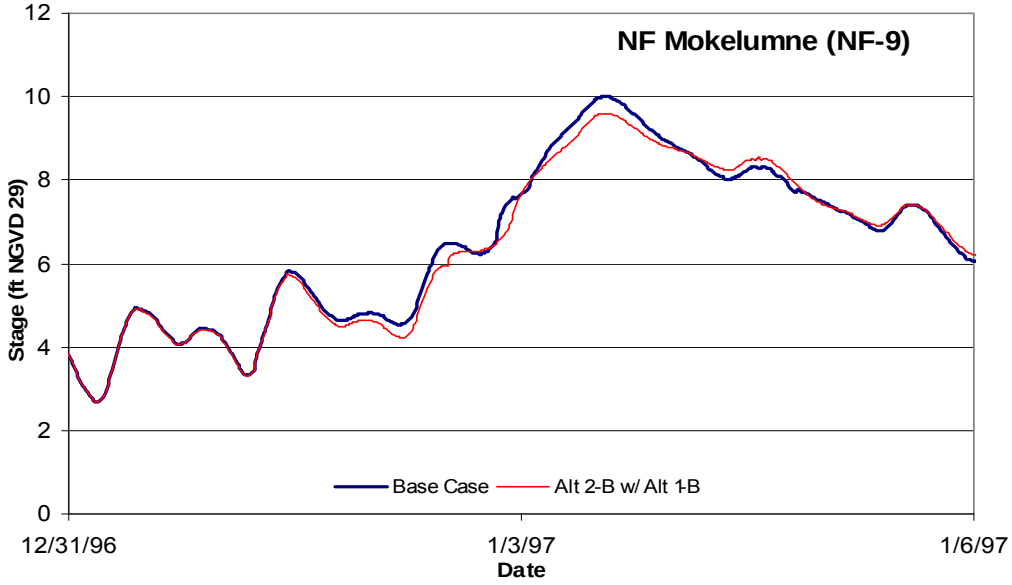


Figure E-23. Model Results at NF-9 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-B w/ 1-B and the Base Case (Alternative NP).

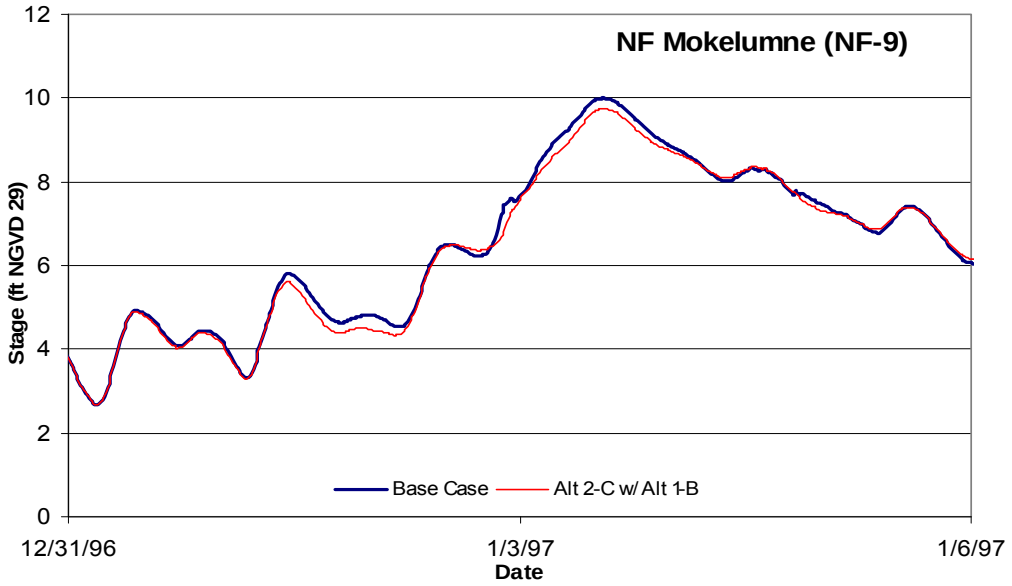


Figure E-24. Model Results at NF-9 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-C w/ 1-B and the Base Case (Alternative NP).

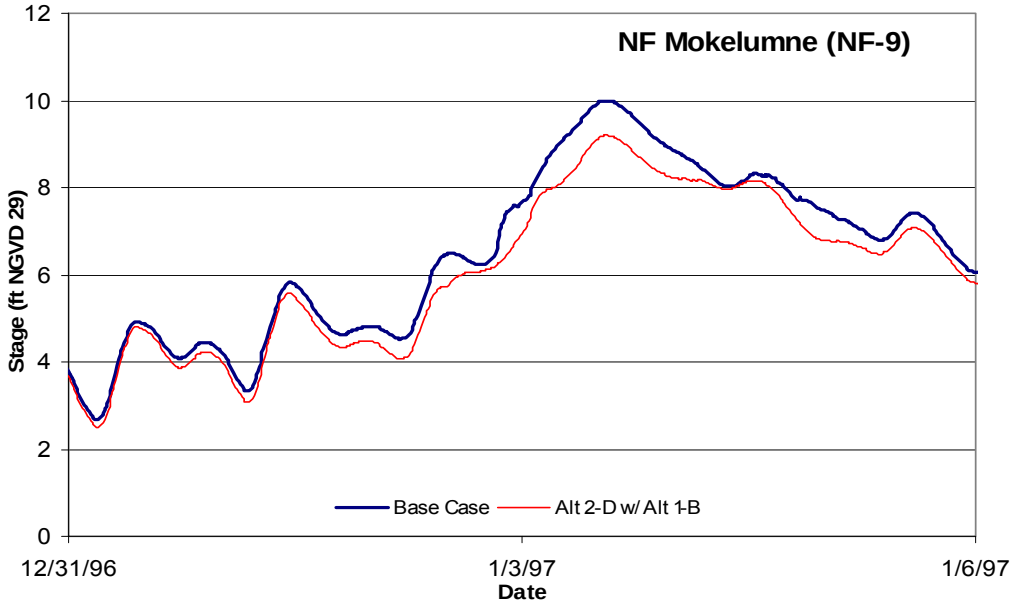


Figure E-25. Model Results at NF-9 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-D w/ 1-B and the Base Case (Alternative NP).

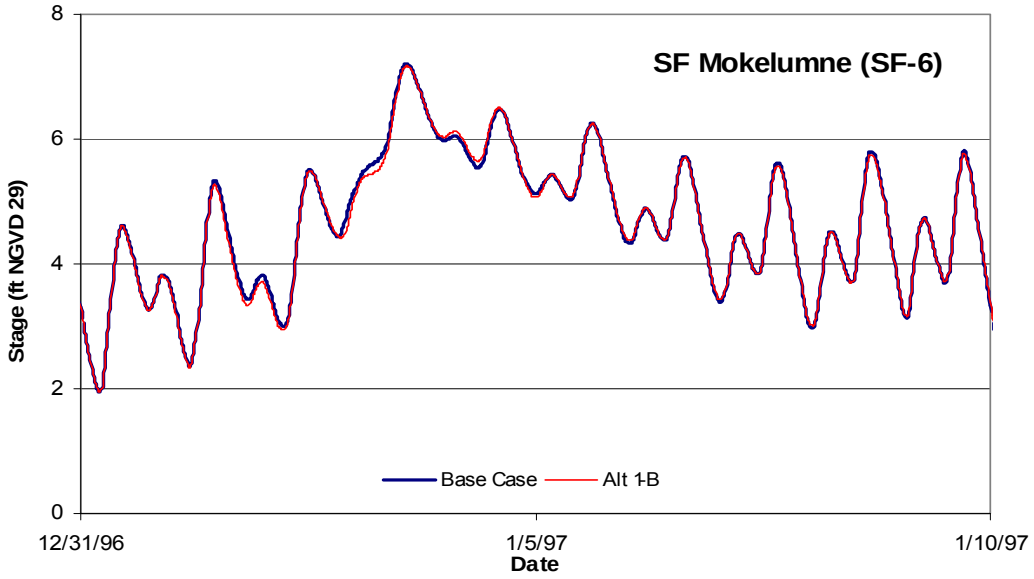


Figure E-26. Model Results at SF-6 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between 1-B and the Base Case (Alternative NP).

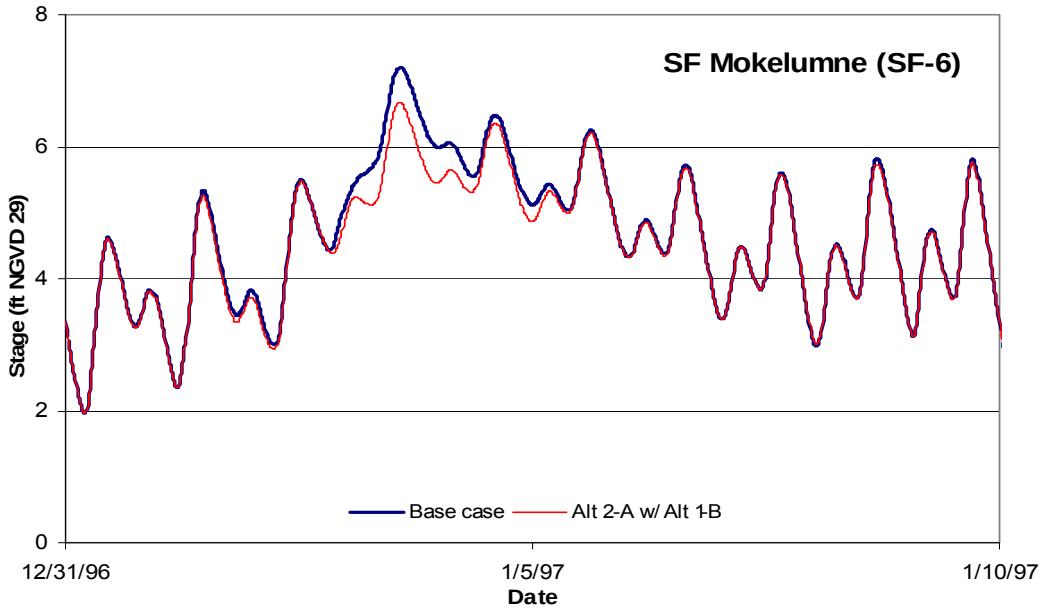


Figure E-27. Model Results at SF-6 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-A w/ 1-B and the Base Case (Alternative NP).

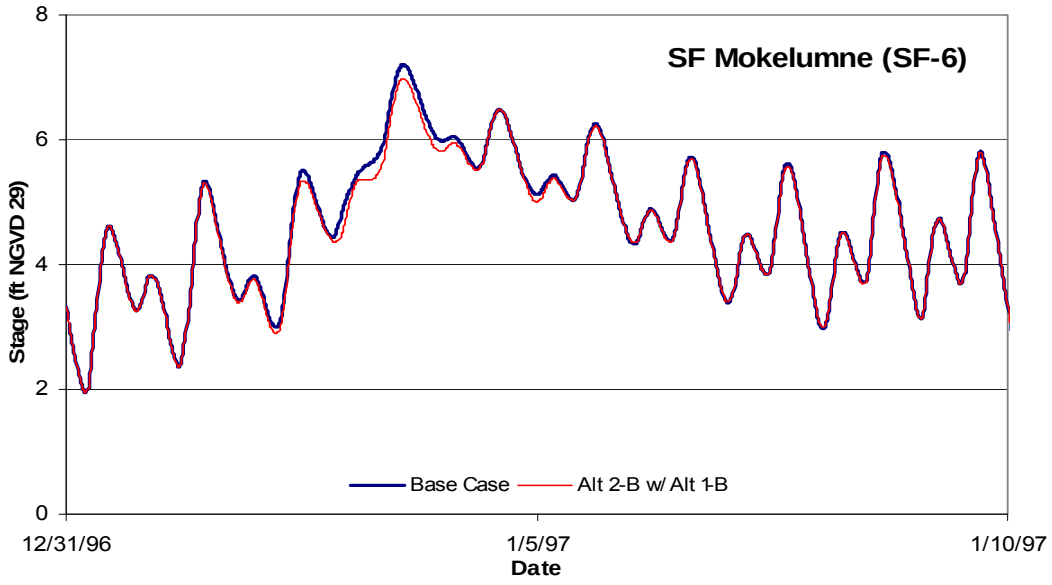


Figure E-28. Model Results at SF-6 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-B w/ 1-B and the Base Case (Alternative NP).

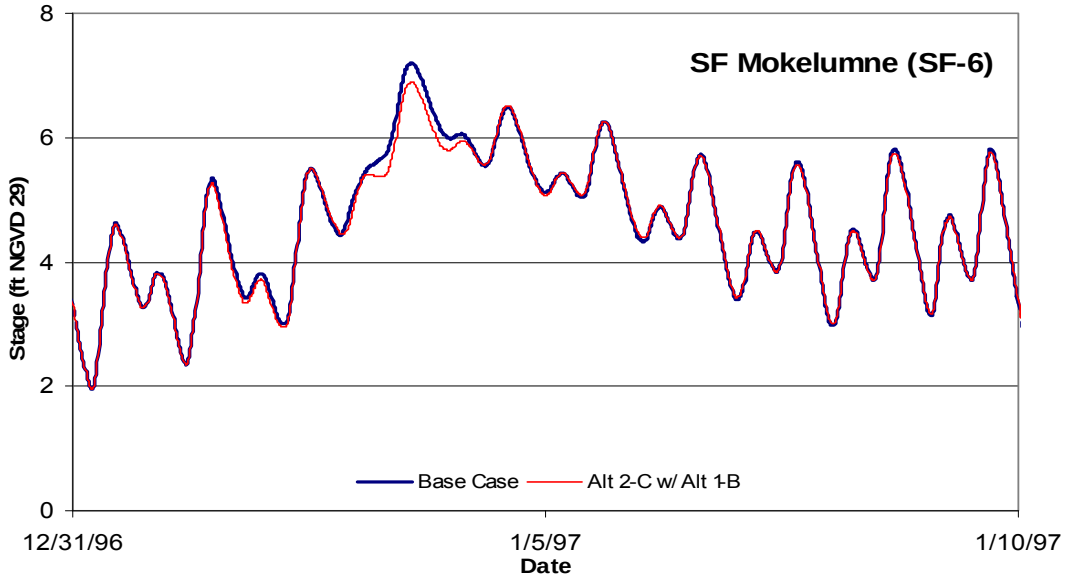


Figure E-29. Model Results at SF-6 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-C w/ 1-B and the Base Case (Alternative NP).

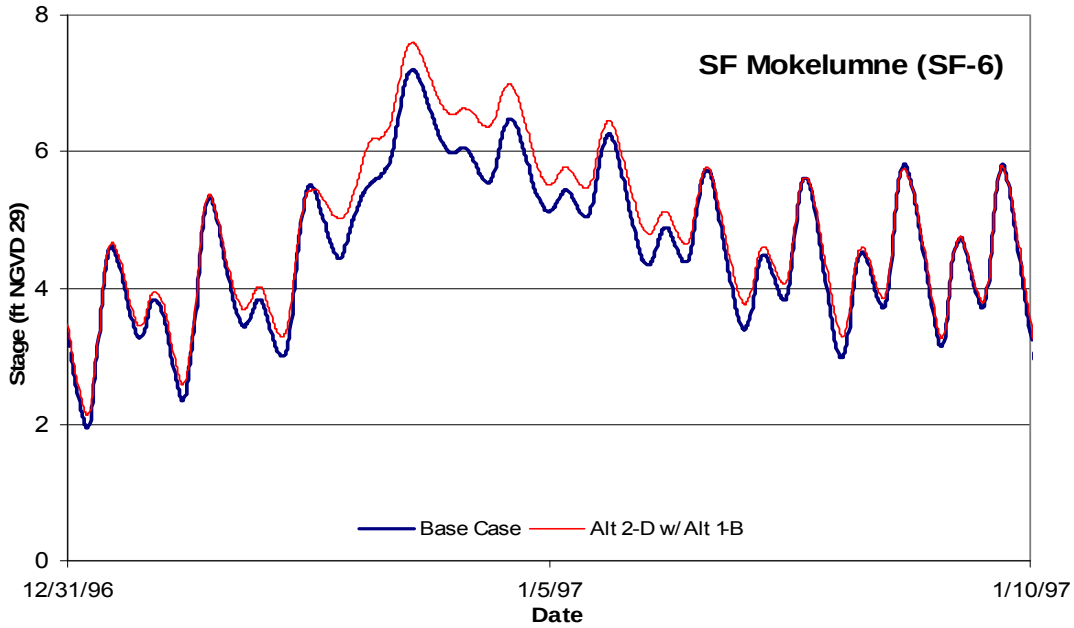


Figure E-30. Model Results at SF-6 (for location, see Figure A-5) for the 1997 Flood Hydrology (with no levee failure): Comparison Between Alternative 2-D w/ 1-B and the Base Case (Alternative NP).

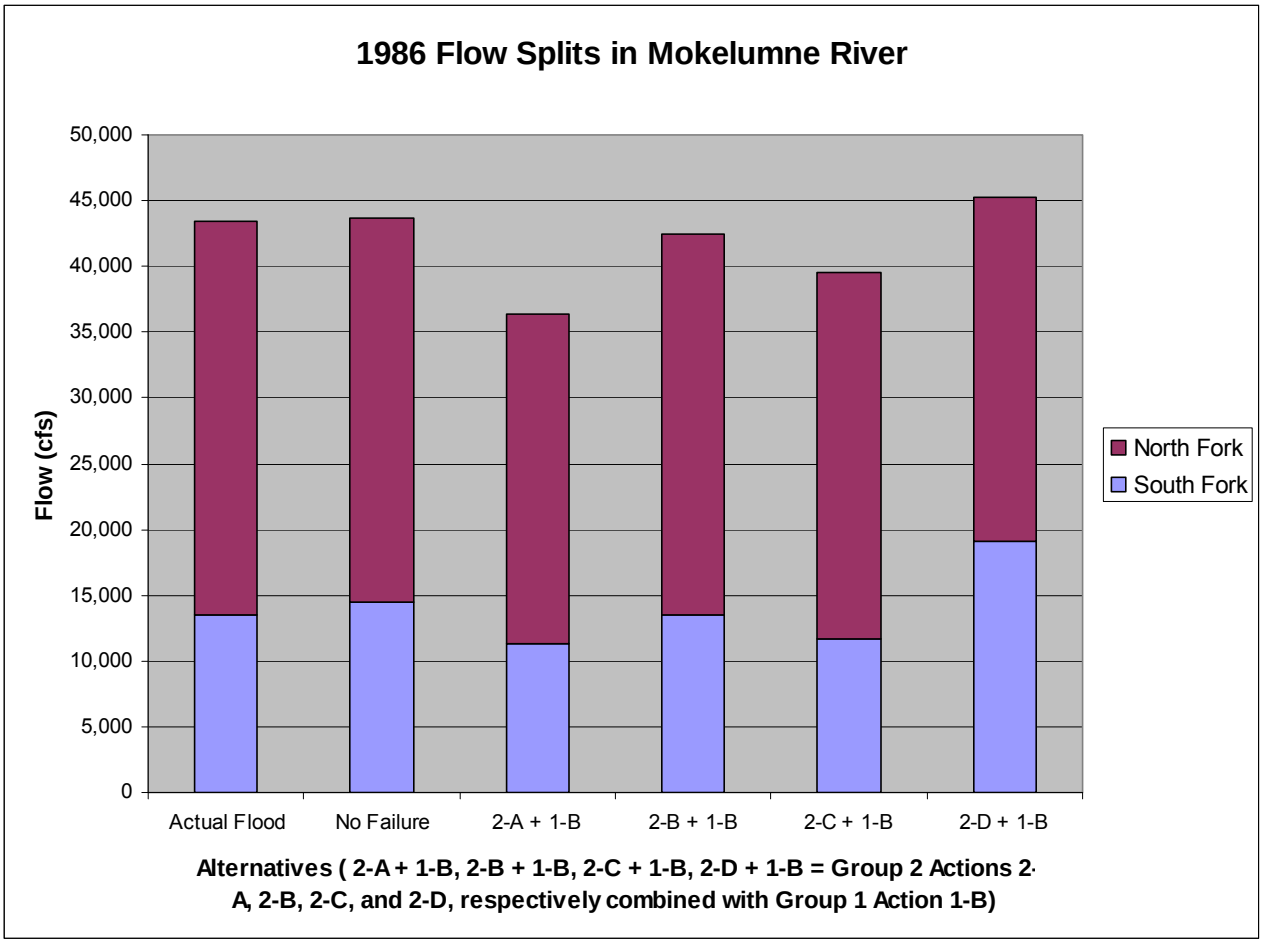


Figure E-31. Flow Splits in the South and North Fork of the Mokelumne River for the 1986 Flood Hydrology.

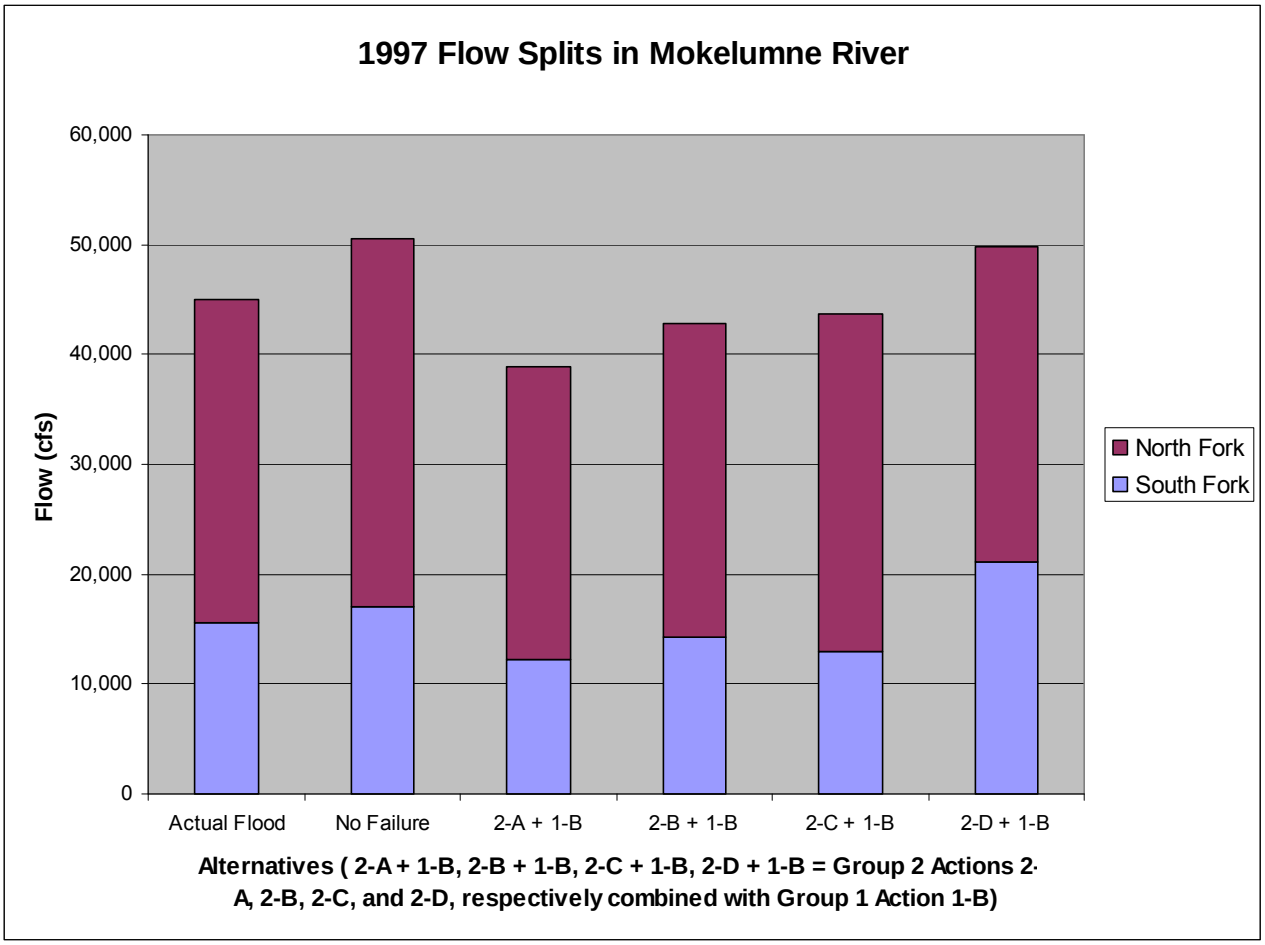


Figure E-32. Flow Splits in the South and North Fork of the Mokelumne River for the 1997 Flood Hydrology.

Table E-9. Comparison of Group 2 Project Alternatives: Maximum Velocities (ft/sec) at Key Points

Index Point[1]	1986 Flood						1997 Flood					
			Group 2 Alternatives, Combined with Alternative 1-B						Group 2 Alternatives, Combined with Alternative 1-B			
	Actual Flood	No Levee Failure	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D	Actual Flood	No Levee Failure	Alternative 2-A	Alternative 2-B	Alternative 2-C	Alternative 2-D
BF-1	3.2	3.0	3.6	3.6	3.6	3.9	3.0	3.2	3.6	3.4	4.5	3.7
MR-2	4.5	4.6	3.7	3.7	3.6	3.9	5.1	5.1	3.1	3.3	3.1	3.5
NH-4	2.9	2.6	2.6	2.6	2.6	2.2	3.1	2.8	2.8	2.8	2.8	1.9
SF-5	3.9	4.1	3.6	3.9	4.0	4.2	4.8	4.7	4.1	4.5	4.4	4.7
NF-8	5.2	4.9	4.6	5.4	4.8	4.5	5.3	5.4	5.0	5.9	5.2	4.9
NF-9	4.5	4.9	4.6	5.4	4.8	4.5	4.2	4.4	4.1	4.3	4.3	4.0

[1] For Index Point locations, see Figure E-5.

Low Flow Simulations

Simulations of low flows for different Project Alternatives were performed for the 1998, 1999, and the 2000-yr hydrology events. The results of the low flow modeling are presented similarly to the high flow runs. Because the detention basin elements in Alternatives 2-A thru 2-C do not come into play at low flow, only the Group 1 Actions were modeled for the low flow events. The maximum stage at each of the model index points for each of the runs are shown in Table E-10 for 1998 hydrology, Table E-11 for the 1999 hydrology, and Table E-12 for 2000 hydrology.

Stage hydrographs for the 1999 hydrology, are shown in Figures E-33 thru E-43 at representative points including New Hope, Benson's Ferry, and downstream locations on the North and South Forks of the Mokelumne River. The plots are focused in the time windows where changes are observed. These provide a comparison of stage duration with and without the Project Alternative. A full set of stage hydrographs at each index point for each modeled hydrology can be made available on CD by request.

Table E-10. Comparison of Group 1 Project Alternatives: Water Level Impacts for 1998 Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)			
		1998 Flood	Group 1 Alternatives		
			1-A	1-B	1-C
BF-1	Benson's Ferry	15.2	13.8	14.0	14.0
MR-2	Mokelumne River	10.9	8.8	9.2	9.2
SG-3	Snodgrass Slough	10.0	9.8	9.8	9.8
NH-4	New Hope	8.5	8.4	8.4	8.4
SF-5	SF[1] Mokelumne	7.5	7.4	7.4	7.4
SF-6	SF Mokelumne	7.3	7.3	7.3	7.3
SF-7	SF Mokelumne	7.3	7.2	7.2	7.2
NF-8	NF Mokelumne	8.2	8.2	8.1	8.2
NF-9	NF Mokelumne	7.4	7.3	7.3	7.3
NF-10	NF Mokelumne	7.2	7.2	7.2	7.2
MC-11	McConnell	47.3	47.3	47.3	47.3
TC-12	Twin Cities Road	28.3	28.3	28.3	28.3
LR-13	Lambert Road	10.9	10.9	10.9	10.9
PP-14	Point Pleasant	N/A	N/A	N/A	N/A
TT-15	Terminous Tract	7.2	7.2	7.2	7.2
NS-16	Confluence of NF and SF	7.1	7.1	7.1	7.1

[1] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

Table E-11. Comparison of Group 1 Project Alternatives: Water Level Impacts for 1999 Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)			
		1999 Flood	Group 1 Alternatives		
			1-A	1-B	1-C
BF-1	Benson's Ferry	14.2	13.0	13.2	13.2
MR-2	Mokelumne River	9.4	6.9	8.0	8.0
SG-3	Snodgrass Slough	7.0	6.9	6.9	6.9
NH-4	New Hope	5.9	5.8	5.9	5.9
SF-5	SF[1] Mokelumne	4.7	4.6	4.7	4.7
SF-6	SF Mokelumne	4.5	4.5	4.5	4.5
SF-7	SF Mokelumne	4.6	4.6	4.6	4.6
NF-8	NF Mokelumne	5.6	5.6	5.6	5.6
NF-9	NF Mokelumne	4.9	4.8	4.9	4.9
NF-10	NF Mokelumne	4.8	4.7	4.8	4.8
MC-11	McConnell	43.1	43.1	43.1	43.1
TC-12	Twin Cities Road	25.8	25.8	25.8	25.8
LR-13	Lambert Road	7.4	7.4	7.4	7.4
PP-14	Point Pleasant	N/A	N/A	N/A	N/A
TT-15	Terminous Tract	4.4	4.4	4.4	4.4
NS-16	Confluence of NF and SF	4.7	4.7	4.7	4.7

[1] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

Table E-12. Comparison of Group 1 Project Alternatives: Water Level Impacts for 2000 Flood Hydrology

Index Point	Location	Peak Stage (ft NGVD 29)			
		2000 Flood	Group 1 Alternatives		
			1-A	1-B	1-C
BF-1	Benson's Ferry	12.8	11.9	11.9	11.9
MR-2	Mokelumne River	8.9	7.1	8.0	7.9
SG-3	Snodgrass Slough	7.4	7.2	7.2	7.1
NH-4	New Hope	6.5	6.2	6.2	6.2
SF-5	SF[1] Mokelumne	5.9	5.7	5.8	5.8
SF-6	SF Mokelumne	5.7	5.6	5.7	5.7
SF-7	SF Mokelumne	5.6	5.6	5.6	5.6
NF-8	NF Mokelumne	6.2	6.0	6.1	6.0
NF-9	NF Mokelumne	5.8	5.6	5.8	5.7
NF-10	NF Mokelumne	5.5	5.6	5.6	5.6
MC-11	McConnell	41.9	41.9	41.9	41.9
TC-12	Twin Cities Road	24.8	24.8	24.8	24.8
LR-13	Lambert Road	7.9	7.9	7.9	7.9
PP-14	Point Pleasant	N/A	N/A	N/A	N/A
TT-15	Terminous Tract	5.6	5.6	5.6	5.6
NS-16	Confluence of NF and SF	5.5	5.5	5.5	5.5

[1] SF, NF: South Fork and North Fork of Mokelumne River, respectively.

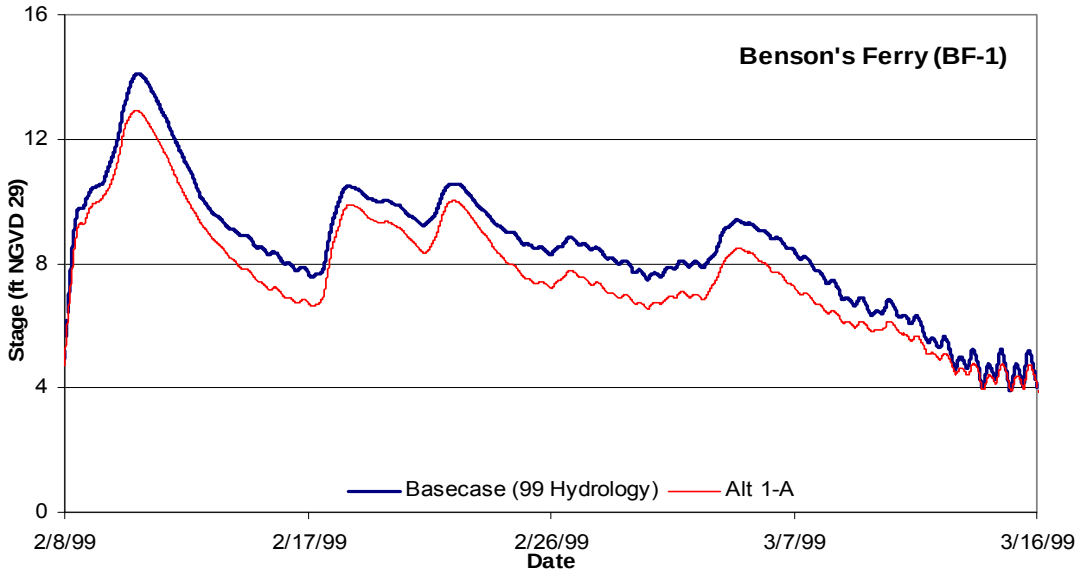


Figure E-33. Model Results at Benson's Ferry for the 1999 Flood Hydrology Showing the Impact of Alternative 1-A Compared to Alternative NP (No Project)

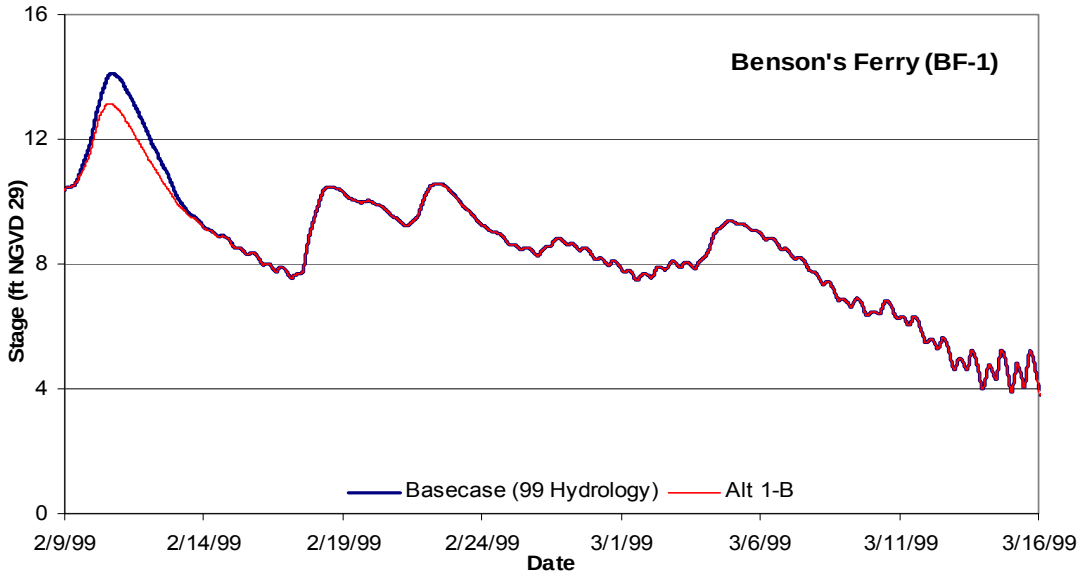


Figure E-34. Model Results at Benson's Ferry for the 1999 Flood Hydrology Showing the Impact of Alternative 1-B Compared to Alternative NP (No Project).

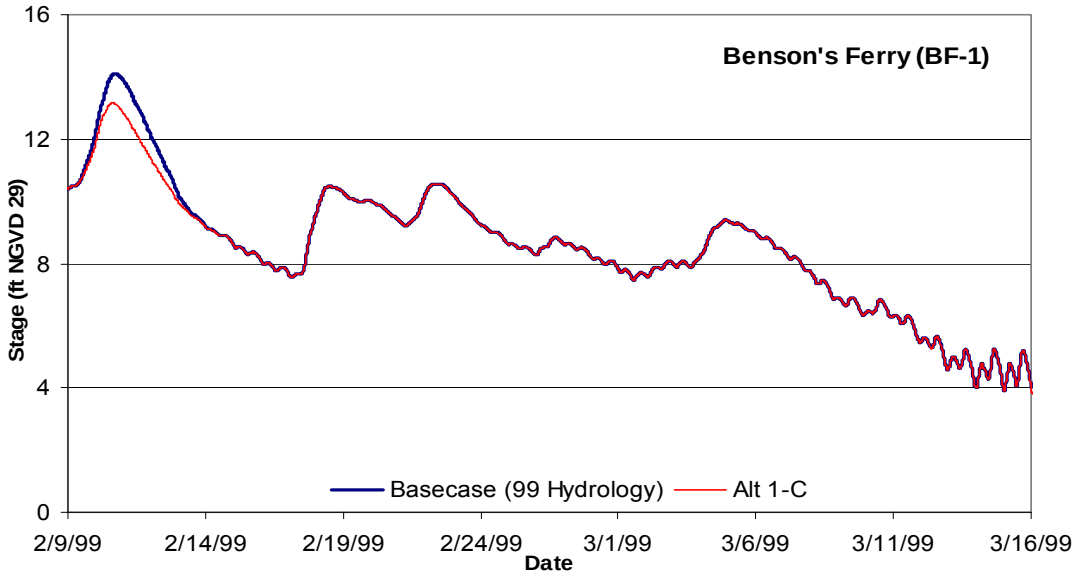


Figure E-35. Model Results at Benson's Ferry for the 1999 Flood Hydrology Showing the Impact of Alternative 1-C Compared to Alternative NP (No Project).

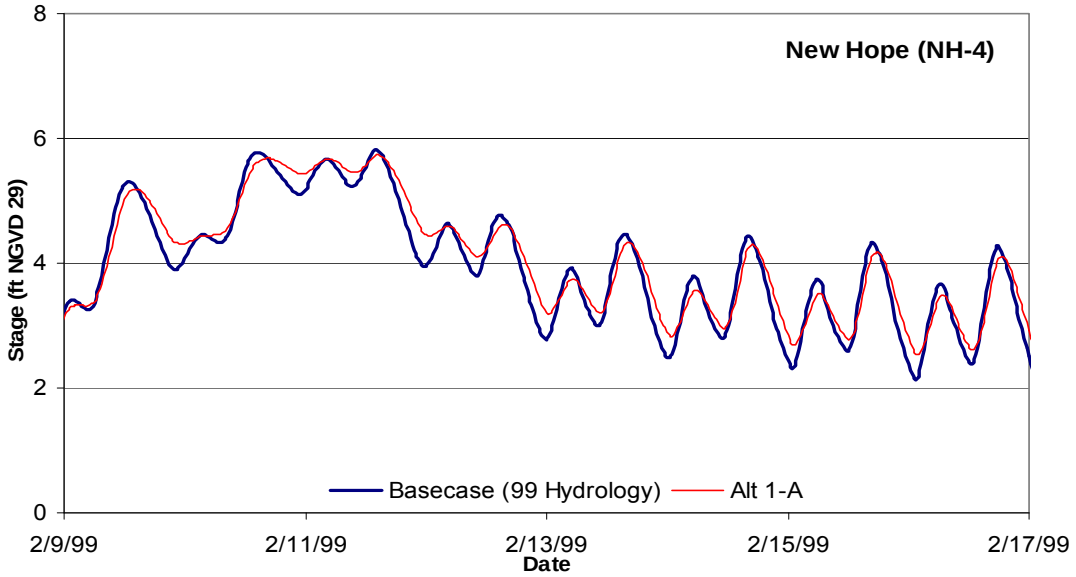


Figure E-36. Model Results at New Hope for the 1999 Flood Hydrology Showing the Impact of Alternative 1-A Compared to Alternative NP (No Project).

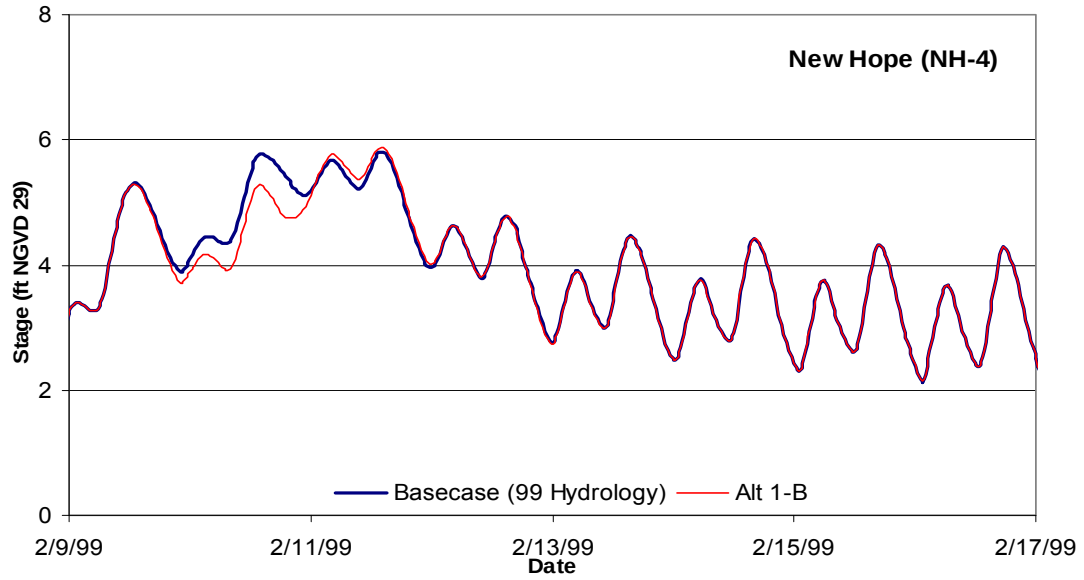


Figure E-37. Model Results at New Hope for the 1999 Flood Hydrology Showing the Impact of Alternative 1-B Compared to Alternative NP (No Project).

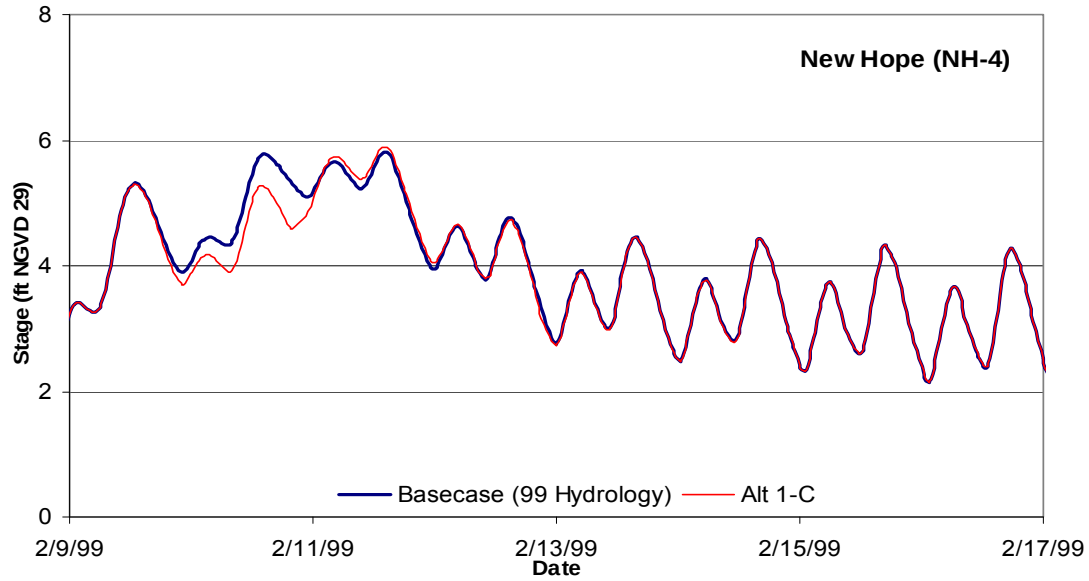


Figure E-38. Model Results at New Hope for the 1999 Flood Hydrology Showing the Impact of Alternative 1-C Compared to Alternative NP (No Project).

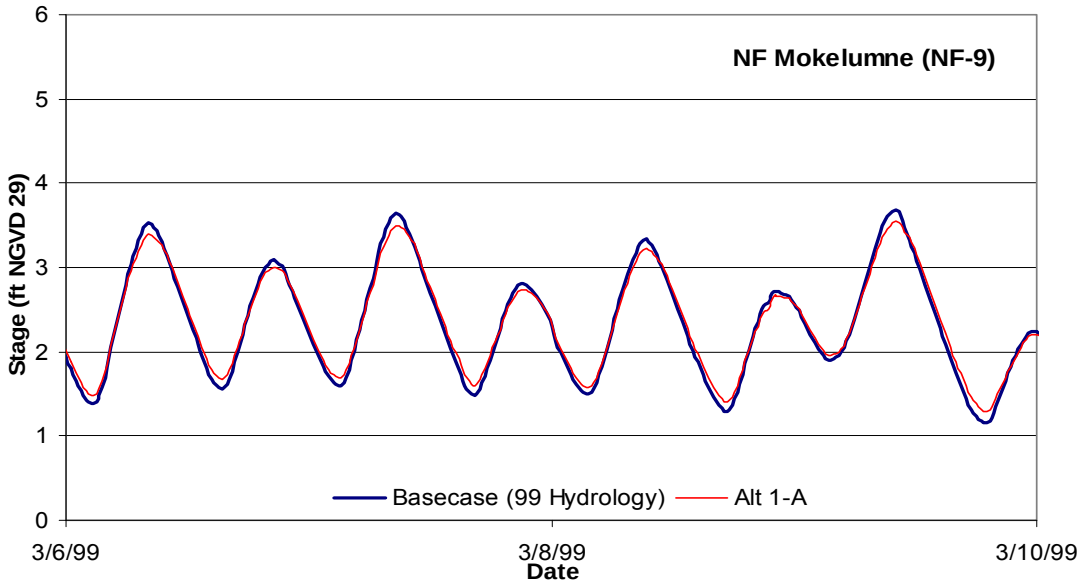


Figure E-39. Model Results at NF-9 (for location, see Figure A-5) for the 1999 Flood Hydrology Showing the Impact of Alternative 1-A Compared to Alternative NP (No Project).

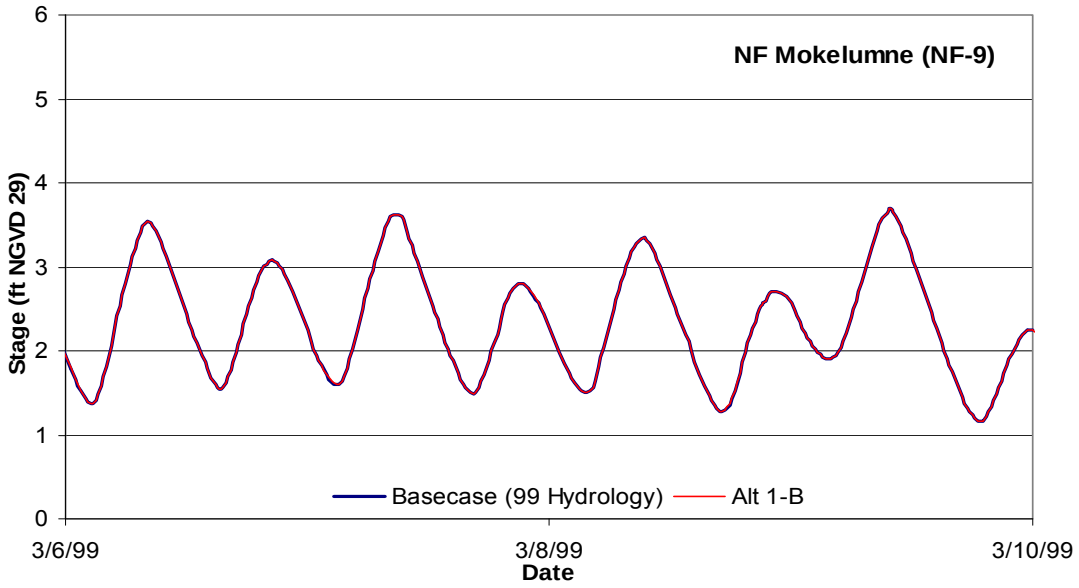


Figure E-40. Model Results at NF-9 (for location, see Figure A-5) for the 1999 Flood Hydrology Showing the Impact of Alternative 1-B Compared to Alternative NP (No Project).

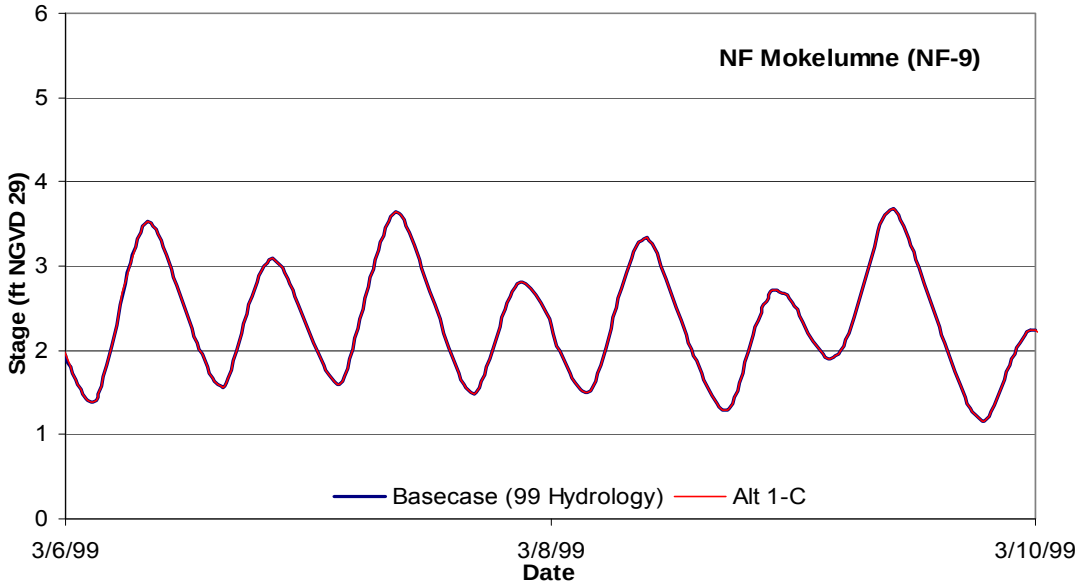


Figure E-41. Model Results at NF-9 (for ocation, see Figure A-5) for the 1999 Flood Hydrology Showing the Impact of Alternative 1-C Compared to Alternative NP (No Project).

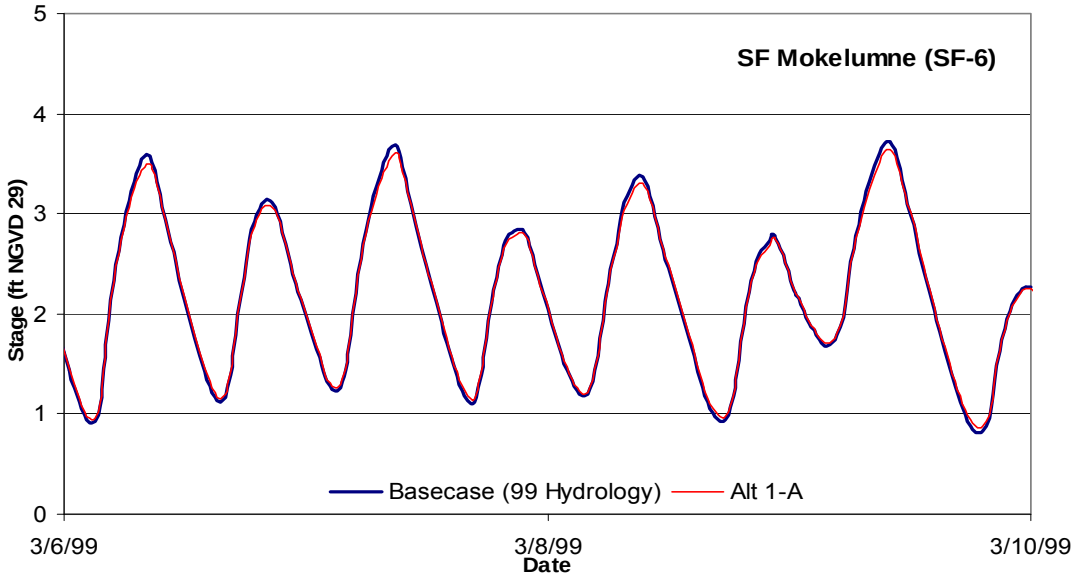


Figure E-42. Model results at SF-6 (for location, see Figure A-5) for the 1999 flood hydrology showing the impact of Alternative 1-A compared to Alternative NP (No Project).

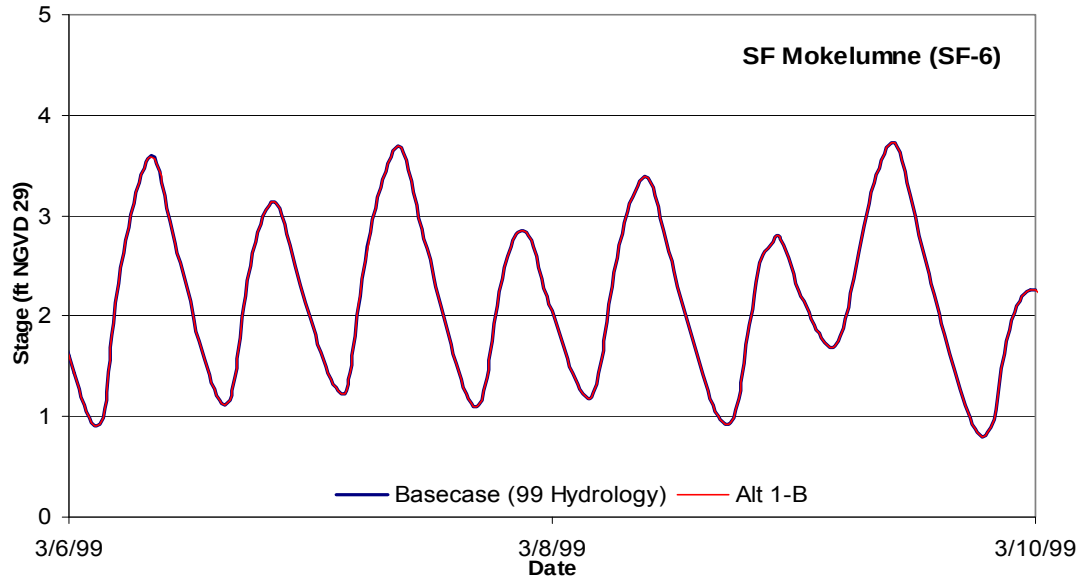


Figure E-43. Model Results at SF-6 (for location, see Figure A-5) for the 1999 Flood Hydrology Showing the Impact of Alternative 1-B Compared to Alternative NP (No Project).

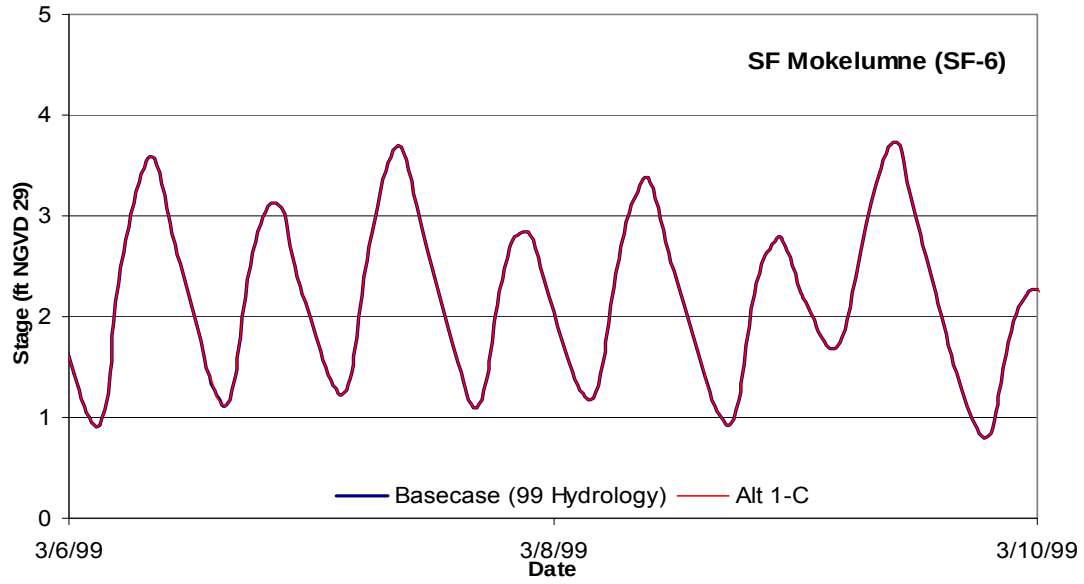


Figure E-44. Model Results at SF-6 (for location, see Figure A-5) for the 1999 Flood Hydrology Showing the Impact of Alternative 1-C Compared to Alternative NP (No Project).

References

Blake, Stephen H., 2001. An unsteady hydraulic surface water model of the Lower Cosumnes River, California, for the investigation of floodplain dynamics (Master's Thesis, University of California, Davis, 2001).

Danish Hydraulic Institute, 2000. MIKE11 Reference manual, Appendix A. Scientific background, Danish Hydraulic Institute.

Guay, J.R., J.G. Harmon, et al., 1998. Flood-inundation map and water-surface profiles of selected frequencies, Cosumnes River and Deer Creek, Sacramento County, California. Sacramento, U.S. Department of the Interior, U.S. Geological Survey.

Hammersmark, Chris T., 2002. Hydrodynamic Modeling and GIS Analysis for the Habitat Potential and Flood Control Benefits of the Restoration of a Leveed Delta Island (Master's Thesis, University of California, Davis, 2002).

Moughamian, Raffi J., 2005. Water Quality Modeling in the California North Delta Area (Master's Thesis, University of California, Davis, 2005).

Powledge, George R., D.C. Ralston, P. Miller, Y.H. Chen, P.E. Clopper, and D.M. Temple, 1989. "Mechanics of Overflow Erosion on Embankments. II: Hydraulic and Design Considerations," Journal of Hydraulic Engineering, Vol. 115, No. 8, August 1989, p. 1056-1075.

Skogerboe, G. V., and Hyatt, M. L., 1967 "Analysis of Submergence in Flow Measuring Flumes." Journal of the Hydraulics Division, ASCE, Vol. 93, No. HY4, July.

U.S. Army Corps of Engineers, *Mokelumne River, California 1% Flood at Franklin 1990*, May 1990.

U.S. Army Corps of Engineers, *Sacramento District, Downstream flood impacts for the proposed Lambert Road outlet facility*, 1988.

Vick, J., E. Andrews, et al. 1997. Analysis of opportunities for restoring a natural flood regime on the Cosumnes River floodplain. Philip Williams and Associates, LTD.