

Flood Control and Levee Stability

Note: The term “Project levee” is generally used to refer to federal project levees that are under the jurisdiction of the U.S. Army Corps of Engineers. In order to avoid confusion regarding the ownership and jurisdiction of the Bacon Island, Webb Tract, Bouldin Island, and Holland Tract levees, these levees are referred to as “DW Project levees” in this section.

Introduction

This section describes recent changes to the existing environmental conditions and regulatory setting of the Project area, summarizes the unchanged affected environment, and describes changed environmental effects related to flood control and levee stability for the Project. This section contains a review and update of the 2000 RDEIR/EIS utilities, public services, and highways impact assessment, incorporated by reference in the 2001 FEIR. The utilities, public services, and highways impacts of the Project were analyzed most recently in the 2001 FEIS, which also served as a basis for this analysis.

The 2001 FEIR and 2001 FEIS concluded that the Project alternatives would affect flood control and levee stability for the Reservoir and Habitat Islands. Since that time, there have been minor changes in the affected environment and regulatory setting. However, there have been no changes in the Project that result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects on flood control or levee stability.

The 2001 FEIR and 2001 FEIS “Levee Stability and Seepage” analysis has been updated here to reflect current environmental conditions on and around the Project islands. Information on the DW Project islands’ levee design as determined by recommendations put forth in the Hultgren-Tillis Preliminary Design Report (Hultgren-Tillis 2003) recommendations for seepage mitigation, and considerations for projected sea-level rise are incorporated into this update. These changes are minor and do not affect the results of the analysis reported in the 2001 FEIR and 2001 FEIS.

Identification of the Project’s specific places of use does not affect flood control and levee stability in any way that alters the conclusions of the 2001 FEIR and 2001 FEIS. The Project will not have any direct effects on flood control and levee stability in the places of use; the effects on flood control and levee stability,

if any, associated with the provision of Project water to the place of use are addressed in Chapter 5, “Cumulative Impacts,” and Chapter 6, “Growth-Inducing Impacts.”

Summary of Impacts

Table 4.3-1 provides a summary and comparison of the impacts and mitigation measures for flood control and levee stability from the 2001 FEIR, 2001 FEIS, and this Place of Use EIR.

Table 4.3-1. Comparison between Delta Wetlands Project 2010 Place of Use EIR and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures for Flood Control and Levee Stability

2001 FEIR and 2001 FEIS Impacts and Mitigation Measures	Differences between 2010 Place of Use EIR Impacts and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures
ALTERNATIVES 1 AND 2	
<p>Impact D-1: Change in Long-Term Levee Stability on Reservoir Islands (LTS-M) Mitigation Measure RD-1: Adopt Final Levee Design That Achieves Recommended Factor of Safety and Reduces Risk of Catastrophic Levee Failure</p>	<p>Impact FC-1: Improvement in Long-Term Levee Stability on Reservoir Islands (LTS) Mitigation: No mitigation is required. The proposed levee design has changed; however, this impact has not changed. No mitigation is required as final levee designs are subject to engineering review before construction. Reservoir Island levees will be designed to exceed PL84-99 standards and provide necessary revetment on both the slough side and reservoir side to protect against erosive forces from waves, wind, and overtopping.</p>
<p>Impact D-2: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS-M) Mitigation Measure RD-2: Modify Seepage Monitoring Program and Seepage Performance Standards</p>	<p>Impact FC-2: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS) Mitigation: No mitigation is required. This impact has not changed. However, the changes recommended in Mitigation Measure RD-2 in the 2001 FEIR and 2001 FEIS have since been incorporated into the Seepage Monitoring Program (described in Chapter 2 of this document under Project Environmental Commitments), making mitigation for this effect no longer necessary. Final levee designs are subject to engineering review before construction. Reservoir Island levees will be designed to include a core trench and interceptor well system to provide a levee seepage barrier.</p>
<p>Impact D-3: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>	<p>Impact FC-3: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) Mitigation: No mitigation is required. This impact has not changed. Final levee designs are subject to engineering review before construction. Reservoir Island levees will be designed to exceed PL84-99 standards and provide necessary revetment on both the slough side and reservoir side to protect against erosive forces from waves, wind, and overtopping.</p>

2001 FEIR and 2001 FEIS Impacts and Mitigation Measures	Differences between 2010 Place of Use EIR Impacts and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures
<p>Impact D-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>	<p>Impact FC-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) Mitigation: No mitigation is required. This impact has not changed. Final levee designs are subject to engineering review before construction.</p>
<p>Impact D-5: Change in Potential for Levee Failure on Project Islands during Seismic Activity (LTS-M) Mitigation Measure RD-1: Adopt Final Levee Design That Achieves Recommended Factor of Safety and Reduces Risk of Catastrophic Levee Failure</p>	<p>Impact FC-5: Change in Potential for Levee Failure on Project Islands during Seismic Activity (LTS) Mitigation: No mitigation is required. The proposed levee design has changed. No mitigation is required as final levee designs are subject to engineering review before construction. Reservoir and Habitat Island levees will be designed to meet or exceed PL84-99 standards and provide improved protection against seismic acceleration.</p>
<p>Impact D-6: Increase in Long-Term Levee Stability on Habitat Islands (B) Mitigation: No mitigation is required.</p>	<p>Impact FC-6: Increase in Long-Term Levee Stability on Habitat Islands (B and LTS) Mitigation: No mitigation is required. This impact has not changed. Final levee designs are subject to engineering review before construction. Habitat Island levees will be designed to meet PL84-99 standards and provide necessary revetment on the slough side to protect against erosive forces from waves, wind, and overtopping.</p>
<p>ALTERNATIVE 3: <i>Differences in Alternative 3 impacts correspond with differences in Alternative 1 and 2 impacts and are described above.</i></p>	
<p>Impact D-7: Change in Long-Term Levee Stability on Reservoir Islands (LTS-M) Mitigation Measure RD-1: Adopt Final Levee Design that Achieves Recommended Factor of Safety and Reduces the Risk of Catastrophic Levee Failure</p>	<p>Impact FC-1: Change in Long-Term Levee Stability on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>
<p>Impact D-8: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS-M) Mitigation Measure RD-2: Modify Seepage Monitoring Program and Seepage Performance Standards</p>	<p>Impact FC-2: Potential for Seepage from Reservoir Islands to Adjacent Islands (LTS) Mitigation: No mitigation is required.</p>
<p>Impact D-9: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>	<p>Impact FC-3: Potential for Wind and Wave Erosion on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>
<p>Impact D-10: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>	<p>Impact FC-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands (LTS) Mitigation: No mitigation is required.</p>
<p>Impact D-11: Change in Potential for Levee Failure on DW Project Islands during Seismic (LTS-M) Mitigation Measure RD-1: Adopt Final Levee Design that Achieves Recommended Factor of Safety and Reduces the Risk of Catastrophic Levee Failure</p>	<p>Impact FC-5: Change in Potential for Levee Failure on Project Islands during Seismic Events (LTS) Mitigation: No mitigation is required.</p>

2001 FEIR and 2001 FEIS Impacts and Mitigation Measures
Differences between 2010 Place of Use EIR Impacts and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures

Note: SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial.

Summary of Changes, New Circumstances, and New Information

Changes in the affected environment, regulatory setting, and environmental effects of the Project related to flood control and levee stability are described in the Existing Conditions section below. A summary of findings based on that consideration follows. While there are new circumstances and new information affecting flood control and levee stability, these changes are minor and will not result in new significant effects or increase the severity of effects.

Substantial Changes in the Project

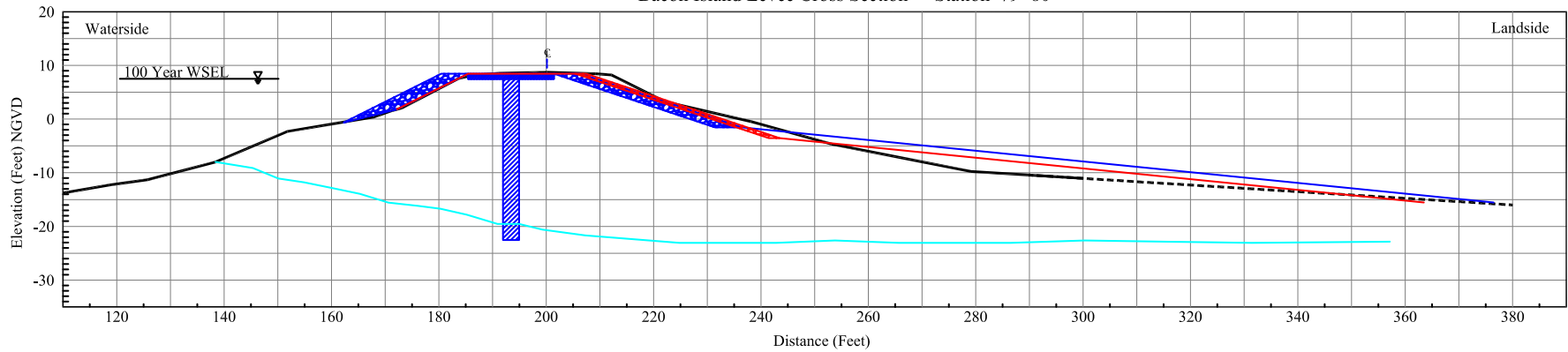
Since the 2001 FEIR and 2001 FEIS were completed, the levee design has been improved. Principally, the levee cross section has been increased, and new levee standards adopted to ensure consistency with the CALFED program. Additionally, the Seepage Monitoring Program has been updated to incorporate the changes recommended under Mitigation Measure RD-2 in the 2001 FEIR and 2001 FEIS. These changes are described below and in Chapter 2 and do not result in any changes in the severity of previously identified effects on flood control and levee stability.

Proposed Levee Design

The 2001 FEIR and 2001 FEIS included two distinct levee designs, one for the Reservoir Islands and one for the Habitat Islands. The Reservoir Islands were to be designed to PL84-99 geometry standards, while the Habitat Islands were to be designed to the DWR Bulletin 192-82 standards. Since the 2001 FEIR and 2001 FEIS, CALFED and DWR have adopted PL84-99 as the preferred design standard for Delta levees.

All four Project islands under all proposed implementation alternatives would be designed to meet or exceed PL84-99 levee geometry standards at the time of construction. (See Figure 4.3-1, “Proposed Reservoir Island Levee Design for Alternatives 1, 2, and 3”). Proposed levee elevations for Habitat and Reservoir Islands are based on the current hydraulic model used by local reclamation district engineers. Sea level rise is incorporated into on-going maintenance to provide adequate flood control. Maintenance activities will add material as necessary in response to actual sea-level rise rates over time. Future sea level rise

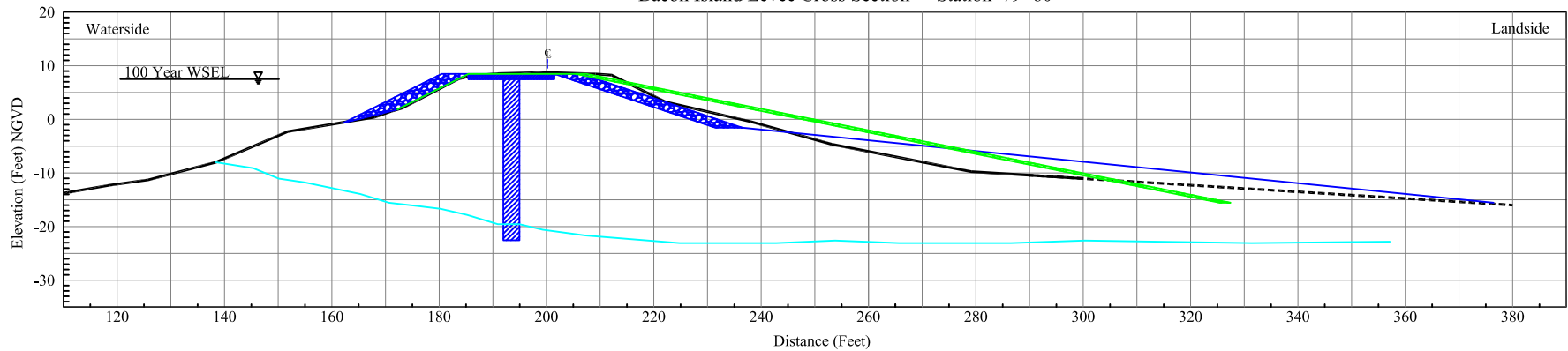
Typical Cross-Section Bacon Island Levee Cross Section - Station 79+80



National Geodetic Survey Benchmark "B95250", Elev. 8.268 feet, NAVD 88

MBK Field Book # 158 - 11/2003, MBK Field Notes [R:\4290.10 - 11/2003] and KSN Field Notes 11/2003

Typical Cross-Section Bacon Island Levee Cross Section - Station 79+80



National Geodetic Survey Benchmark "B95250", Elev. 8.268 feet, NAVD 88

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LEGEND

- BASE DESIGN
- 2009 DESIGN
- 2001 "BROKEN-SLOPE" DESIGN
- APPROXIMATE BASE OF EXISTING FILL
- 2001 "CONSTANT-SLOPE" DESIGN
- ▨ CORE TRENCH
- ▨ AGGREGATE BASE
- ▨ RIP-RAP

2009 Design Assumptions

1. Final levee crest elevation is 1.5' above 100-year flood elevation.
2. The waterside levee slope will be 2:1
3. The landside levee slope will be 3:1 on the upper end and 10:1 on the lower end. The 3:1 and 10:1 slopes intersect at 10 to 15 feet below the levee crest. Typical assumes 10 feet below levee crest.
4. The core trench will be 3' wide, excavated to 3' below the base of existing fill, and will be backfilled with low-permeability material.
5. Final crown width will be 26'. Assumes 16' for the levee crest plus 5' of riprap on either side.
6. 100-year flood elevation based on the USACE's 1992 report: "Sacramento-San Joaquin Delta, California, Special Study: Hydrology"

**Figure 4.3-1
Proposed Reservoir Island Levee Design for Alternatives 1, 2, and 3**

predictions are not included in water surface calculations used in development of the proposed levee design.

Reservoir Islands

The proposed Reservoir Island levee design includes a revetment-protected slough side slope (2:1) and in oversteepened areas a waterside notch to create a bench and flatter slope. The crest would be widened to 45 feet and be surfaced with an all-weather access road. The design also includes placement of fill and revetment on a 3:1 upper landside slope and a 10:1 lower toe berm slope that extends interior until it intersects the island surface to create a landside buttress. The 45-foot constructed crest width provides room for additional fill in anticipation of post-construction settling. The wider initial levee top width will allow future maintenance activities to place material to increase heights to accommodate anticipated settling and sea-level rise, while still providing minimum top widths and acceptable side slopes after the material placement. This design also includes the addition of a core trench to reduce through-levee seepage potential, increasing stability and safety. This proposed design is also similar to the geometric recommendations put forth in the 2009a Hultgren-Tillis report that investigated the levee stability of a “seismically repairable” levee, using Webb Tract for the analysis (Hultgren-Tillis Engineers 2009a). The seismically repairable geometry included similar crest width and side slopes and was found to perform well during large seismic events, allowing quick repairs and increased stability. Figure 4.3-1 also shows the previously proposed Reservoir Island levee designs, as described in the 2001 FEIR and 2001 FEIS, for comparison. Final levee design will be subject to engineering review.

Habitat Islands

Since the adoption of PL84-99 as the preferred standard for Delta levees, the habitat levee design based on the Bulletin 192-82 standard was reevaluated. The change resulting from the adoption of the PL84-99 standard was a slight decrease in overall height from the 2001 FEIR and 2001 FEIS design. In accordance with PL84-99 levee geometry standards, the new height provides 1.5 feet of freeboard above the 100-year water surface elevation and not the 300-year water surface elevation. In the Project area this change allows for approximately a 0.5-foot reduction in overall levee height from the proposed levee height in the 2001 FEIR and 2001 FEIS.

Depth of Impounded Water

The 2001 FEIR and 2001 FEIS analyzed the proposed impoundment of water to depths up to 6 feet (National Geodetic Vertical Datum of 1929 [NGVD 29]), which is a static datum and stable point of reference for this Project. The proposed operations of all Alternatives now will limit the maximum

impoundment depth to depths not exceeding 4 feet (NGVD 29) on any of the Project islands.

NGVD 29 is the datum specified in the California Division of Safety of Dams (DSOD) regulations and is commonly used throughout the Delta. Each reservoir island currently has accurate benchmarks with elevation reported on the NGVD 29 datum. If needed in the future, this datum can be converted to another datum, but that will not change the allowable elevation of water in the reservoirs.

New Circumstances

Since the 2001 FEIR and 2001 FEIS was completed, there have been many additional studies in the Delta and events that call into question the long-term sustainability of flood control and levee stability in the Delta. Specifically, the Delta Risk Management Strategy (DRMS) (URS 2008) evaluated the potential for catastrophic levee failure, including failure of the levee on Jones Tract, and determined that “business as usual” practices are not sustainable in the Delta. Phase 1 of the DRMS project was completed in early 2009. Phase 2 of the DRMS project currently is evaluating long-term risk reduction options for the Delta and Suisun Marsh levees, but no discrete set of actions has yet been made available. Separately, the ISI considered potential for operational and maintenance changes to Project islands and several miles of levees throughout the Delta. The ISI results were summarized in the 2006 Supplemental Report (California Department of Water Resources 2006) which concluded that seepage models applied to estimate seepage rates at Webb Tract and Bacon Island were reasonable. It went further to identify riprap as the recommended slope protection against wind and wave action. The risk analysis concluded that annual failure probability and the expected dollar risk during the 50-year Project life are about 6 to 10 times greater under the existing conditions than for the proposed Project. Overall the proposed Project was considered to be technically feasible to safely design, construct, and operate.

Additionally, since the 2001 FEIR and 2001 FEIS was completed, CALFED and DWR adopted PL84-99 as the target levee standard for all Delta levees to achieve. This new circumstance slightly alters the guidance for levee construction design standards on the Habitat Islands.

While there are new circumstances affecting flood control and levee stability, these changes do not require major revisions to the previous analysis because there are no new significant impacts or increase in the severity of impacts.

New Information

There is no new information of substantial importance that would result in an increase in severity of effects on flood control and levee stability. The key sources of new information reviewed or used to prepare this section include:

- Integrated Storage Investigations, In-Delta Storage Program Draft Report on Engineering Investigations, CALFED Bay-Delta Program, May 2002 (CALFED Bay-Delta Program 2002a);
- Integrated Storage Investigations, In-Delta Storage Program Draft Summary Report, CALFED Bay-Delta Program, May 2002 (CALFED Bay-Delta Program 2002b);
- In-Delta Storage Program Final Draft Report on Risk Analysis, URS December 2001;
- In-Delta Storage Program Draft Report on Embankment Design Analysis, URS June 2003 (URS Corporation 2003a);
- In-Delta Storage Program Draft Report on Flooding Analysis, URS June 2003 (URS Corporation 2003b);
- In-Delta Storage Program Draft Report on Risk Analysis, URS June 2003 (URS Corporation 2003c);
- Preliminary Design Report, Reservoir Island Levees, Delta Wetlands Project, Sacramento–San Joaquin River Delta, Hultgren-Tillis Engineers, March 11, 2003;
- Geotechnical Evaluation, Sea Level Rise, Webb Tract Levees, Sacramento–San Joaquin Delta, Hultgren-Tillis Engineers, December 10, 2009 (Hultgren-Tillis Engineers 2009a);
- Geotechnical Evaluation, Seismically Repairable Levee, Webb Tract, Sacramento–San Joaquin Delta, Hultgren-Tillis Engineers, December 30, 2009 (Hultgren-Tillis Engineers 2009b);
- In-Delta Storage Program Draft Report on Risk Analysis, URS May 31, 2005; and,
- 2006 Supplemental Report to the 2004 Draft State Feasibility Study In-Delta Storage Project, DWR May 2006.

Existing Conditions

This section discusses changes in the existing conditions or regulatory setting since the 2001 FEIR and 2001 FEIS.

Regulatory Setting

The regulatory setting has experienced little change since the completion of the 2001 FEIR and 2001 FEIS. The regulatory setting described in the 2001 FEIR and 2001 FEIS is included by reference. Updates or clarifications to regulations are summarized below.

Federal

U.S. Army Corps of Engineers

EC 1165-2-211

In July 2009, the Corps issued EC 1165-2-211, a water resource policy mandating that every Corps coastal activity influenced by tidal waters include potential relative sea-level change in the starting water surface elevation, where appropriate. To comply, projects must determine how sensitive plans and designs are to rates of future local mean sea-level change, how this sensitivity affects calculated risk, and what design or operations and maintenance measures should be implemented to minimize adverse consequences while maximizing beneficial effects.

The Project is not a Corps activity subject to EC 1165-2-211; however, the Project will include maintenance operations that will require placement of levee materials as necessary to maintain freeboard in response to actual sea-level rise rates.

ETL 1110-2-571

Post Hurricane Katrina investigations brought scrutiny to levee management practices throughout the United States, particularly within communities that rely upon levees to protect against flood waters and tidal surges. In response, in April 2009, the Corps issued ETL 1110-2-571, a levee management policy concerning landscape planting and vegetation management. This policy does not permit landscape planting to be incorporated into the design of flood damage reduction projects, where the safety of the structure may be compromised, or effective surveillance, monitoring, inspection, maintenance, and flood-fighting of the facility are adversely impacted. DW Project levees are not subject to Corps jurisdiction because they are not Corps levees or a flood damage reduction project; however, the surface treatments and landscaping plans generally will be consistent with the Corps's ETL guidance.

Levees meeting eligibility requirements for the PL84-99 program must comply with ETL 1110-2-571 or a vegetation variance adopted by the local Corps District and approved by headquarters. However, at this time, the Project applicant does not intend to participate in the PL84-99 program and therefore is not required to meet the ETL vegetation standards.

State

California Division of Safety of Dams

The DSOD has oversight and approval authority for structures that are considered dams under the Water Code. Some levees are “dams” as defined by California Water Code section 6002, and as such, are required to meet DSOD’s standards and design review requirements. Dams under DSOD jurisdiction are artificial barriers that are at least 25 feet high or have an impounding capacity of at least 50 acre feet.

However, Water Code section 6004(c) specifically excludes structures in the Sacramento-San Joaquin Delta “...if the maximum possible water storage elevation of the impounded water does not exceed four feet above mean sea level, as established by the United States Geological Survey 1929 Datum.” Since the Project design has incorporated operational controls to limit the depth of storage below DSOD jurisdictional levels, DSOD oversight is not applicable for the alternatives analyzed below. Rising sea level is not considered in the current DSOD regulations.

Central Valley Flood Protection Board Encroachment Permit

The Central Valley Flood Protection Board (CVFPB) Encroachment Permit (formerly The Reclamation Board) requires an encroachment permit for any non-federal activity along or near federal flood damage reduction project levees and floodways or in CVFPB-designated floodways to ensure that proposed local actions or projects do not impair the integrity of existing flood damage reduction systems to withstand flood conditions. The permits are conditioned upon receipt of permission from the Corps for alteration of the federal project works pursuant to Section 408. The Project will not require a CVFPB Encroachment Permit, as the DW Project levees are not federal flood damage reduction project levees.

Local

Bacon and Bouldin Islands are located in San Joaquin County, and Webb and Holland Tracts are located in Contra Costa County. The local regulations established by San Joaquin and Contra Costa Counties that pertain to the islands that fall within their respective boundaries are described below.

Contra Costa County General Plan Safety Element

This element requires, in part, that flood protection levees protecting areas of intensive urban and suburban development meet the standards of the U.S. Army Corps of Engineers while protecting the beneficial uses of the Delta and its water. Geologic and engineering investigations are a prerequisite to construction of

public and private facilities in affected areas. The safety element includes goals to ensure public safety by directing development away from flood-prone areas and to mitigate risk related to flood hazards and subsidence.

DW's Project levees do not provide flood protection for areas of intensive urban and suburban development, they will undergo extensive engineering review including seismic analyses similar to those completed for Webb Tract (Hultgren-Tillis 2009), through operation they will help to slow oxidation processes that are linked to subsidence, and accordingly the Safety Element does not apply to the Project.

San Joaquin County General Plan Safety Element

The San Joaquin County General Plan flood hazard section includes discussion of ordinance requirements for development in the 100-year flood zone. The Proposed Project does not include development that is restricted by ordinance.

San Joaquin County Department of Engineering is responsible for the review and design of storm drainage requirements in the unincorporated county area, while city engineering departments review projects within their separate jurisdictions. Coordination between the various agencies and governmental departments concerned with flood control and storm drainage systems occurs during project reviews.

The proposed Project final design and construction documents are subject to engineering review and will be required to meet the guidance of the general plan safety element for portions of the Project within San Joaquin County.

Affected Environment

Flood control and levee stability conditions are, for the most part, as they were presented in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference and summarized below. The only change to the Project that affects flood control and levee stability is the proposed design of the improved levees associated with implementation of the Project, the proposed depth of impounded water, and the alteration of the Seepage Monitoring Program and Seepage Performance Standards.

The Project applicant proposes to improve the levees surrounding the Project islands. Under existing conditions, levee conditions vary greatly. A typical present levee condition is a 20-foot-wide crest at an approximate elevation of +8.5 feet above mean sea level with an exterior (water-side) slope of 2:1 (horizontal to vertical) and an interior (land-side) slope of 4:1.

Under the Proposed Project in the 2001 FEIR and 2001 FEIS, a typical improved levee would have an exterior slope of 2:1, a crest about 26 feet wide (including the thickness of erosion protection) at an elevation providing 1.5 feet of

freeboard above the 100-year flood elevation, and a 3:1 initial interior slope transitioning to 10:1 approximately 10 to 15 feet below the crest elevation, creating a wide landside toe. The new slopes would meet or exceed PL84-99 standards. This design is similar to what is now proposed; however, the new proposed design for Reservoir Island Levees includes a greater crest width of 45 feet. This creates a larger and more stable levee than that proposed in 2001.

Levee-improvement materials would be obtained primarily from sand deposits on the Project islands. Each borrow area generally would be located more than 400 feet inward from the toe of a levee so that the borrow excavation would not cause structural impacts on the levee and would be at least 2,000 feet inward from the final toe of an improved levee where a greater setback is necessary to control seepage.

The interior slopes of these perimeter levees would be protected from erosion by conventional rock revetment similar to that used on existing exterior slopes. In areas where final design studies indicate that wave splash and run-up potentially could erode the levee crest if it is unprotected, the levee crest would be hardened or the erosion-protection facing would be extended up as a splash berm.

The Project applicant would implement a seepage monitoring program to provide early detection of seepage problems caused by Project operations. A network of wells (i.e., piezometers) located immediately across the channels from the reservoir islands would be used to monitor seepage; background wells at distant locations would establish water-level changes that typically occur without Project operations. The Project applicant has proposed seepage performance standards for the Project that would be used to determine the amount of interceptor-well pumping needed to ensure that seepage is reduced to acceptable levels.

Environmental Commitments

Since publication of the 2000 RDEIR/EIS, the following environmental commitments related to flood control and levee stability have been added to the Project description. These environmental commitments are described in detail in Chapter 2.

Prior Agreement with East Bay Municipal Utility District

The Settlement Agreement between the East Bay Municipal Utility District (EBMUD) and the Project applicant, signed on September 13, 2000, stipulates that a Reservoir Island design review board will serve as an oversight committee for the Reservoir Islands while construction is ongoing. A Reservoir Island monitoring and action board will serve as a technical review committee for operations of the Reservoir Islands and for enforcing the implementation of the Project Seepage Control Plan.

Improved Reservoir Island Levee Design

Based on the recommendations by Hultgren-Tillis Engineers contained in the 2003 document, “Preliminary Design Report: Reservoir Island Levees, Delta Wetlands Project,” the proposed Reservoir Island levee design has been improved to provide increased stability and reduced through-levee seepage potential, as described above under “Proposed Levee Design.” This improved levee design is considered an environmental commitment.

Seepage Monitoring and Control System

The Seepage Monitoring Program, which was developed to avoid seepage issues and to provide early detection of seepage problems caused by the Project, has been updated to incorporate the changes recommended under Mitigation Measure RD-2 in the 2001 FEIR and 2001 FEIS. The Project applicant has now committed to this program as an environmental commitment. The changes to the Seepage Monitoring Program are as follows:

- Locate the background monitoring wells at least 1,000 feet from the nearest seepage monitoring wells.
- Use more than one background monitoring well for each row of seepage monitoring wells.
- Use at least 1 year of data to establish reference water levels in all the background monitoring wells and in at least half of the seepage monitoring wells.
- Reevaluate seepage performance standards 2, 5, and 10 years after reservoir operations begin and then every 10 years.

The Seepage Monitoring Program is described in further detail in Chapter 2 of this document under Project Environmental Commitments.

Environmental Effects

Methods and Significance Criteria

The analytical approach, impact mechanisms, and significance criteria remain as presented in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference.

The flood control and levee stability impact analysis considered several criteria for determining the significance of impacts related to this resource. The analysis took into account both relevant criteria contained in Appendix G of the State CEQA Guidelines (Association of Environmental Professionals 2009) and Project-specific criteria developed by the lead agency to address potential impacts unique to the Project’s location and elements.

An alternative is considered to have a significant impact on flood control and levee stability if it would:

- substantially decrease levee stability on the Project islands during Project construction;
- substantially induce additional seepage on adjacent islands when compared to No-Project conditions;
- substantially decrease regional supplies of levee material;
- substantially decrease long-term levee stability on the Project islands below long-term stability under existing conditions; or
- substantially increase risk of cumulative levee failure and flooding in the Project vicinity.

Impacts and Mitigation Measures

The impacts on flood control and levee stability resulting from implementation of the Project were described in detail in the 2001 FEIR and 2001 FEIS and are summarized briefly in Table 4.3-1. Where there have been no changes to the impact analysis, the 2001 FEIR and 2001 FEIS is incorporated by reference. Changes in the levee design for habitat and Reservoir Islands—necessitate updating the impact analysis. These changes result in no new significant environmental effects or a substantial increase in the severity of previously identified significant effects on flood control and levee stability.

Proposed Project (Alternative 2)

With the exception of reduced water storage depths and improved Reservoir Island levee design as described above, the Proposed Project (Alternative 2) remains largely as it was presented in the 2001 FEIR and 2001 FEIS.

Alternative 2 involves storage of water on Bacon Island and Webb Tract (Reservoir Islands) and management of Bouldin Island and Holland Tract (Habitat Islands) primarily for wetlands and wildlife habitat. The Reservoir Islands would be managed primarily for water storage, with wildlife habitat and recreation constituting secondary uses.

Impact FC-1: Improvement in Long-Term Levee Stability on Reservoir Islands

The proposed levee design includes improved side slopes, erosion countermeasures (revetment), seepage reduction measures, and overall mass to improve stability over existing conditions and provide adequate flood control characteristics. Both reservoir and habitat levees would be reconstructed (i.e., improved) to geometries that meet or exceed PL84-99 standards. Both Reservoir and Habitat Islands would be maintained to address settlement and sea-level rise.

However, implementation of the improved levee design would reduce this impact to a less-than-significant level.

Mitigation

No mitigation is required.

Impact FC-2: Potential for Seepage from Reservoir Islands to Adjacent Islands

Implementation of Alternative 2 could increase the potential for seepage beneath the Reservoir Island levees to adjacent islands during Project operation by increasing the hydraulic head between Reservoir Islands and adjacent islands during periods of storage. This impact is considered significant. However, implementation of the Seepage Monitoring and Control System to determine seepage flow rates, collect excess seepage, and maintain acceptable seepage rates and quantities over the life of the Project, as described in Chapter 2 of this document under Project Environmental Commitments, would reduce this impact to a less-than-significant level.

Mitigation

No mitigation is required.

Impact FC-3: Potential for Wind and Wave Erosion on Reservoir Islands

The proposed levee design considered wind and wave erosion. Levee heights are recommended to accommodate expected wave heights, and revetment designs are determined to dissipate wave energy and counteract erosive forces. This impact is less than significant.

Mitigation

No mitigation is required.

Impact FC-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands

The potential for erosion of levee toe berms at pump stations and siphon stations on Reservoir Islands was presented in the 2001 FEIR and 2001 FEIS as Impact D-4. The 2001 FEIR and 2001 FEIS concluded that this impact is less than significant. The current Reservoir Island levee design would further reduce erosion potential through placement of revetment and erosion countermeasures that are typical for Delta islands and easily maintainable over the life of the Project. This impact remains less than significant.

Mitigation

No mitigation is required.

Impact FC-5: Change in Potential for Levee Failure on Project Islands during Seismic Activity

The proposed design for all DW Project levees would meet or exceed PL84-99 levee geometry criteria creating a wide and more stable levee mass that exceeds the existing levee geometry on any of the Project islands. The proposed design would undergo necessary engineering review required by County planning

agencies and the environmental commitments described above; thus, it would provide a more stable levee than would exist without the implementation of the Project. The Project therefore would reduce the potential for levee failure on Project islands during seismic activity as described in the 2009 Hultgren-Tillis report. This impact is considered less than significant.

Mitigation

No mitigation is required.

Impact FC-6: Increase in Long-Term Levee Stability on Habitat Islands

The proposed Habitat Island levee design includes side slopes, erosion countermeasures (revetment), seepage reduction measures, and overall mass to improve stability over existing conditions and provide adequate flood control characteristics. This design would create a larger levee than currently exists and would provide for long term stability through its size, shallow slopes, and improved erosion countermeasures. Habitat Island levees would be constructed to meet PL84-99 geometry and maintained to address settlement and sea-level rise. This impact is considered beneficial and less than significant.

Mitigation

No mitigation is required.

Alternative 1

With the exception of reduced water storage depths and improved Reservoir Island levee design as described above, Alternative 1 remains largely as it was presented in the 2001 FEIR and 2001 FEIS.

Alternative 1 involves storage of water on Bacon Island and Webb Tract (Reservoir Islands) and management of Bouldin Island and Holland Tract (Habitat Islands) primarily for wetlands and wildlife habitat. The Reservoir Islands would be managed primarily for water storage, with wildlife habitat and recreation constituting secondary uses.

Impacts on flood control and levee stability and mitigation measures of Alternative 1 are the same as those of Alternative 2, as described above. Alternative 1 varies in description from Alternative 2 only by the operational period.

Alternative 3

With the exception of reduced water storage depths and improved Reservoir Island levee design as described above, Alternative 3 remains largely as it was presented in the 2001 FEIR and 2001 FEIS and the associated impacts and mitigation measures are summarized below.

Alternative 3 involves storage of water on Bacon Island, Webb Tract, Bouldin Island, and Holland Tract, with secondary uses for wildlife habitat and recreation. The portion of Bouldin Island north of SR 12 would be managed as a wildlife habitat area and would not be used for water storage. Impacts on flood control and levee stability and mitigation measures of Alternative 3 are the same as those of Alternative 1.

Impact FC-1: Change in Long-Term Levee Stability on Reservoir Islands

This impact is described above under Alternative 2. This impact is considered less than significant.

Mitigation

No mitigation is required.

Impact FC-2: Potential for Seepage from Reservoir Islands to Adjacent Islands

This impact is described above under Impact Alternative 2. This impact is considered significant. However, implementation of the Seepage Monitoring and Control System to determine seepage flow rates, collect excess seepage, and maintain acceptable seepage rates and quantities over the life of the Project, as described in Chapter 2 of this document under Project Environmental Commitments, would reduce this impact to a less-than-significant level.

Mitigation

No mitigation is required.

Impact FC-3: Potential for Wind and Wave Erosion on Reservoir Islands

This impact is described above under Alternative 2. This impact is considered less than significant.

Mitigation

No mitigation is required.

Impact FC-4: Potential for Erosion of Levee Toe Berms at Pump Stations and Siphon Stations on Reservoir Islands

This impact is described above under Alternative 2. This impact is considered less than significant.

Mitigation

No mitigation is required.

Impact FC-5: Change in Potential for Levee Failure on Project Islands during Seismic Activity

This impact is described above under Alternative 2. This impact is considered less than significant.

Mitigation

No mitigation is required.

No-Project Alternative

The No-Project Alternative remains as it was presented in the 2001 FEIR and 2001 FEIS and is hereby incorporated by reference and briefly summarized below.

Decrease in Long-Term Levee Stability, Increase in Potential for Seepage onto Project Islands, and Increase in Potential for Levee Failure during Seismic Activity

Under the No-Project Alternative, the DW Project levees would continue to be maintained as agriculture levees. Levee geometries (width, side slope, and height) would remain at current levels, with fill placed to repair storm-related damage and material placed to maintain appropriate heights to offset levee settlement and sea-level rise. Hultgren-Tillis' 2009a report, *Geotechnical Evaluation: Sea Level Rise, Webb Tract Levees*, confirms that the existing safety and reliability of the DW Project levees can be maintained with rising sea level by raising the levee crest and providing a broader toe berm (Hultgren-Tillis Engineers 2009b). Maintenance practices would continue at their current levels as the local reclamation districts strive to achieve the adopted PL84-99 standard as the preferred Delta island levee geometry with limited resources.

In anticipation of a potential project, agricultural activities have been reduced over time. The No-Project Alternative would see a return to historical intense agricultural activity on each of the islands. High levels of agricultural land use would return the area to higher levels of subsidence through oxidation of peat soils. This subsidence would increase the hydrostatic pressure on the island levees, increasing the risk of wet weather and dry weather levee seepage problems typical of all Delta islands.

Implementing the No-Project Alternative would provide less flood control benefit and decreased levee stability through greater potential subsidence and greater potential hydrostatic pressure.