Chapter 2. Delta Wetlands Project Alternatives

C-060385

Chapter 2. Delta Wetlands Project Alternatives

DW PROJECT PURPOSE AND NEED

The purpose of the DW project is to divert surplus Delta inflows, transferred water, or banked water for later sale and/or release for Delta export or to meet water quality or flow requirements for the Bay-Delta estuary. Additionally, the DW project will provide managed wetlands and wildlife habitat areas and recreational uses.

The DW project would increase the availability of high-quality water in the Delta for export or outflow by storing water on two reservoir islands, and would compensate for wetland and wildlife effects of the water storage operations on the reservoir islands by implementing a habitat management plan (HMP) on two habitat islands. As an incidental operation of the habitat islands, water released may be sold or used for the same purposes as the water released from the reservoir islands.

The DW project also includes construction of recreation facilities along the perimeter levees on all four DW project islands; operation of a private airstrip on Bouldin Island; and, during periods of nonstorage, management of shallow water within an inner levee system on the reservoir islands.

The following discussions describe Delta export demands, Delta water quality needs, and environmental flow requirements that DW project water could be used to satisfy.

Delta Export Demands

It is the project applicant's intent that DW project operations would help satisfy Delta export demands by augmenting water supply for exports.

Water sent from northern California to central and southern California or to the Bay Area by the SWP, operated by DWR, and the CVP, operated by the U.S. Bureau of Reclamation (Reclamation), must pass through the Delta. Water is diverted from the Delta by the CVP and the SWP; agricultural users of water from approximately 1,800 local irrigation diversions; and cities such as Antioch and Concord to supply the domestic needs of two-thirds of the state's population and irrigate several million acres of farmlands (DWR 1994). Destinations for DW project water could include the SWP, the CVP, and third-party buyers that use the SWP or CVP facilities for transport of water (a process often referred to as "wheeling").

As described in DWR's California Water Plan Update (Bulletin 160-93), demands for water in California are estimated to exceed dependable supplies. Assuming the levels of Delta water supply availability under improved water management, existing SWP facilities, and SWRCB Water Right Decision 1485 (D-1485), issued in 1978, DWR estimated that California would have an annual deficit in dependable supplies of 2.9-4.9 million acre-feet (MAF) of water by 2020. (DWR 1994.) As indicated under the descriptions of the DW project alternatives below, it is estimated that mean monthly discharges for export under the DW project alternatives would total from 188 thousand acre-feet (TAF) to 302 TAF annually.

Delta Water Quality Needs

It is the project applicant's intent that DW project discharges would increase the supply of high-quality water and freshwater releases for outflow from the Delta.

Water quality considerations have a direct bearing on the quantity of Delta water available for use. Delta waters provide a rich habitat for fish and wildlife and are a major source of supply for uses throughout the state. Drinking water for about 20 million Californians flows through the Delta. Water quality parameters such as temperature; turbidity; and oxygen, mineral, dissolved metal, organic, and nutrient content all affect the usability

of water and therefore affect the total quantity available for specific uses and the overall availability of water supplies in California. Urban water supplies diverted from the south Delta, for example, face the threat of increasing water quality degradation resulting from both salinity intrusion and the presence of organic substances and salinity originating in agricultural drainage from Delta islands or tributary streams. The pressures of a steadily growing population, additional requirements for water to meet environmental needs, and potentially more frequent water shortages pose serious water management and risk management problems for California (DWR 1994).

SWRCB has established specific water quality objectives to protect the uses of water in the Bay-Delta. Many of these objectives relate to salinity. The SWP and the CVP are required to release sufficient fresh water to meet these Delta salinity objectives. However, DWR estimates that increasingly stringent water quality standards for public health protection will affect the continued availability and cost of water supplies (DWR 1994).

Environmental Flow Requirements

DW project water could be used to increase water available to meet environmental flow needs, including fishery flow needs, water needs of freshwater wetlands (and Suisun Marsh), and outflow requirements to meet estuarine salinity objectives.

The Bay-Delta estuarine system has long been an important resource to California. More than 100 species of fish use the Bay-Delta system. Some, such as delta smelt and catfish, are year-round residents and others, such as American shad, are in the estuary for only a few months. Some of the species can live only in relatively fresh water and others can survive only in the more saline parts of the Bay. There are also several fish with intermediate salinity tolerance; these are the true estuarine species.

The health of populations of estuarine species is closely linked to the condition of the estuarine environment. The recurrence of drought (both in 1976-1977 and 1987-1992), combined with increasing human demands on water supply, has shown that fish populations and wetland areas require a water supply that is more dependable than that managed now. As a result of natural and human factors, three runs (or races) of chinook salmon in the Central Valley and Klamath/Trinity River system have shown severe population declines in recent years. Additionally, two fish species that use the Bay-Delta estuary, winter-run chinook salmon and delta smelt, are at such low abundance levels that they are listed under the state and federal Endangered Species Acts. An additional fish species, Sacramento splittail, is currently proposed for listing and other fish species are candidates for listing under the federal Endangered Species Act.

Among the many factors affecting the estuarine environment are the rate and timing of freshwater inflow to the estuary; the quantities of fresh water reaching it seasonally, annually, and over a series of years; and diversions from the estuary for both local and export uses. In the past 50 years, developments in the vicinity of the Bay-Delta estuary, along with numerous local, state, and federal water developments on Central Valley tributary streams, caused changes in the timing and amounts of Delta inflows and outflows during most years.

Water-related factors having the greatest effect on the Bay-Delta estuary are:

- Delta inflow,
- flows from the Sacramento River through the Delta Cross Channel (DCC),
- reverse flows,
- water project diversions and local agricultural diversions,
- agricultural return flows, and
- Delta outflow and salinity.

SWRCB, through its water right process, provides the principal forum for establishing the Bay-Delta's environmental flow requirements. SWRCB reserves jurisdiction in water right permits and periodically holds water right hearings in which interested agencies and parties provide evidence supporting their views regarding the water right, public interest, or public trust impacts of a permitted use. SWRCB then sets objectives and operating criteria to provide balanced protection to all recognized beneficial uses.

DWR calculates that environmental demands for water in California are currently at 28.4 MAF and could increase to 28.8 MAF by 2020 (DWR 1994). The flows that may ultimately be required to meet Bay-Delta environmental needs will not be known until many of the decision-making processes currently underway are finalized (see discussion of CVP and SWP requirements in Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives").

SELECTION PROCESS FOR THE DW PROJECT ALTERNATIVES

The DW project alternatives (Alternatives 1, 2, and 3) and the No-Project Alternative were selected to represent a range of project operations for purposes of determining environmental impacts. All alternatives are designed to operate within the objectives of SWRCB's 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (1995 WQCP), adopted May 22, 1995. If the DW project is approved by the lead agencies, actual project operations should be within the range of impacts analyzed in this EIR/EIS.

The project applicant's proposed project consists of storage of water on two reservoir islands and implementation of an HMP on two habitat islands. The operational scenarios presented below as Alternatives 1 and 2 both represent DW's proposed project and differ only with regard to operating criteria for discharge of stored water. Analysis of the proposed project as represented by these two alternatives allows potential impacts of DW's proposed project to be evaluated for the full range of likely DW operations. An additional operational scenario, Alternative 3, consists of use of all four of the DW project islands as reservoirs and provision of limited compensation habitat on Bouldin Island. The "seasonal wetlands" operation of diverting and storing water for discharge to export during winter through summer and creating wetland habitat in fall, as originally proposed in the 1990 EIR/EIS, no longer applies to any of the alternatives. The lead agencies' preferred alternative will be decided after completion of the final EIR/EIS.

Table 2-1 presents an overview of the differences between water storage operations under Alternatives 1, 2, and 3. The alternatives are described in detail in the following sections of this chapter. The section "Alternatives Considered but Not Selected for Detailed Evaluation" presents those alternatives that were first considered during development of the range of project alternatives to meet the requirements of both EPA's Section 404(b)(1) guidelines and NEPA. The alternatives analyzed in detail in this EIR/EIS represent further refinement of the reasonable range of alternatives. If permitted by the Corps, the project will constitute the least environmentally damaging practicable alternative in compliance with Section 404 of the Clean Water Act.

DESCRIPTION OF ALTERNATIVES 1 AND 2

Overview

Alternatives 1 and 2 entail the potential year-round diversion and storage of water on two Delta islands owned by DW (Bacon Island and Webb Tract) and wetland and wildlife habitat creation and management, with the incidental sale of the water used for wetland and wildlife habitat creation, on two Delta islands owned primarily by DW (Bouldin Island and Holland Tract) (Figure 2-1). All the land required for the DW project is currently owned by DW or controlled under an option agreement. The reservoir island operations may include shallow-water management during periods of nonstorage at the discretion of DW and incidental to the proposed project. To operate Alternative 1 or 2, DW would improve levees on the perimeters of the reservoir islands and install additional siphons and water pumps. Inner levee systems would also be constructed on both the reservoir and habitat islands for shallow-water management.

Under Alternative 1 or 2, during periods of availability throughout the year, water would be diverted onto the reservoir islands to be stored for later sale or release. Water would be discharged from the islands into Delta channels for sale for beneficial uses for export or for Bay-Delta estuary needs during periods of demand throughout the year, subject to state and federal regulatory standards, endangered species protection measures, and Delta export pumping capacities. Water discharged into the Delta channels under proposed project operations would mix with Delta inflows from the Sacramento and San Joaquin Rivers and other tributary rivers and would be available as either export water or Delta outflow (e.g., outflow necessary to satisfy 1995 WQCP objectives or other state or federal standards). DW project operations can be adjusted on a daily basis according to hydrologic information and information on fish abundance and location obtained through monitoring.

The DW project islands could also be used for interim storage of water being transferred through the Delta from sellers upstream to buyers served by Delta exports or to meet Bay-Delta estuary outflow requirements (water transfers), or for interim storage of water owned by parties other than DW for use to meet scheduled Bay-Delta estuary outflow requirements or for export (water banking). Such uses could occur only after the transferrers or bankers of the water applied to SWRCB for rights to new points of diversion or rediversion onto

the DW project islands. The frequency and magnitude of these transfer/banking activities is uncertain at this time; each would require separate authorization and may require further environmental documentation beyond that provided for the DW project.

During periods of nonstorage, DW could choose to divert water onto the reservoir islands under riparian claim or senior appropriative water rights for wetland habitat management; typically, diversion would begin after September 1, after an appropriate dry period to allow for growth of wetland plants of value to wintering waterfowl as forage and cover. Wetland habitat created on the reservoir islands would be flooded as storage water becomes available. The inner levee system constructed on each reservoir island would manage shallow-water circulation during nonstorage periods.

Water would be diverted onto the habitat islands to be used for wetland and wildlife habitat creation and management during periods of availability and need. Most likely, the water diversions for wetland management would begin in September and water would be circulated throughout winter. Except for small areas of permanent water, water used on the habitat islands would be discharged on a schedule related to wetland and wildlife values, with drawdown typically by May. As an incidental operation, the water released at this time from the habitat islands may be sold or used for the same purposes as water released from the reservoir islands.

Portions of the habitat islands and the reservoir islands would support recreational activities. Waterfowl hunting would be allowed on all four DW project islands; upland bird hunting would be allowed on the reservoir islands and in specific areas on the habitat islands. Private recreation facilities, including as many as 30 boat berths per facility in adjacent channels and 36 boat berths per facility on the island interiors, vehicle access and parking, and living accommodations, would be located along the perimeter levees on all four DW islands. There may be as many as 38 private recreation facilities on the four islands developed over the life of the project, and each facility may accommodate up to 40 bedrooms. The recreation facilities on all four islands may be operated to support year-round use of the boat docks. Recreational use and location of the recreation facilities on the habitat islands would be subject to restrictions of the HMP; recreational use on the reservoir islands would depend on water storage operations.

A private airstrip located on Bouldin Island would be operated to support DW recreational and maintenance activities. The airstrip is currently used for agricultural operations.

The following sections describe DW's proposed project in detail and describe the differences between the two operational scenarios for the proposed project presented as Alternatives 1 and 2. Details of DW's existing and applied-for water rights and the proposed uses for these rights are provided later in this chapter under "DW's Existing and Pending Water Rights".

Reservoir Islands

Bacon Island and Webb Tract would be managed for water storage under Alternatives 1 and 2. Facilities that would be needed for the proposed water storage operations include intake siphon stations with auxiliary pumps to divert water onto the reservoir islands and pump stations to discharge stored water from the islands. DW proposes to construct two intake siphon stations on each reservoir island with 16 new siphons each, for a total of 64 siphons. One discharge pump station with 32 new pumps would be installed on Webb Tract and a pump station with 40 pumps would be installed on Bacon Island, for a total of 72 new pumps. Where possible, existing siphons and pumps would be modified or upgraded (e.g., by installation of fish screens on siphons) and reused for water operations. Figures 2-2 and 2-3 show the proposed locations of siphon and pump stations and recreation facilities on Bacon Island and Webb Tract, respectively. DW has proposed locations for these facilities; flexibility exists to choose other locations for the siphon and pump stations before initial construction if, at the end of the CEQA/ NEPA process, the lead agencies determine that different locations are desirable because of channel hydraulics or environmental, water quality, or other considerations. Figure 2-4 depicts conceptual cross sections of reservoir islands for full-storage and non-storage operations. Reservoir island operations and features are described below.

Water Storage Operations

Storage Capacity. The reservoir islands would be designed for water storage levels up to a maximum pool elevation of +6 feet relative to mean sea level (based on National Geodetic Vertical Datum data) providing a total estimated initial capacity of 238 TAF, allocated between Bacon Island and Webb Tract as 118 TAF and 120 TAF, respectively. Water availability, permit conditions, and requirements of the DWR Division of Safety of Dams (DSOD) may limit storage capacities and may result in a final storage elevation of less than +6 feet.

The total physical storage capacity of the reservoir islands may increase over the life of the project as a result of soil subsidence (local or regional sinking, mainly resulting from the oxidation of peat soil in the Delta). Subsidence on the reservoir islands is currently estimated to average 2-3 inches per year and is thought to be caused mostly by agricultural operations. With water storage operations replacing agricultural operations, the rate of subsidence on the reservoir islands is expected to be greatly reduced, although some subsidence may still occur. No method currently exists to predict the rate of subsidence on a Delta island used for water storage operations. DW estimates, however, that the reservoir islands could subside at a rate of approximately 0.5 inch per year, even with the cessation of agricultural operations and possible sedimentation during filling and storage. Under this hypothetical scenario for subsidence on the reservoir islands, the storage capacity of the reservoir islands could increase by as much as 9% in 50 years, increasing total storage capacity of the reservoir islands to 260 TAF.

Multiple Storage. DW has applied for permission to allow reservoir islands to be filled, drawn down, and refilled again in years when water availability and demands were appropriate. These years are classified as multiple-storage years. Multiple storage would generally occur during years of moderate rainfall. This management scenario depends on the availability of surplus water early in the year and a demand for the water to allow an early discharge of the reservoir followed by another period of available surplus water.

Carry-Over Storage. During years of low water demand, water would remain in the reservoirs at the end of the water year (i.e., September 30). DW has applied for permission to allow water to remain on a reservoir island for release in subsequent years. Carry-over storage would generally occur during wet years with low demand.

Siphon Station Design. Two new siphon stations for water diversions would be installed along the perimeter of each reservoir island (Figures 2-2 and 2-3). Each siphon station would consist of 16 siphon pipes 36 inches in diameter. Fish screens to prevent entrainment of fish in DW diversions would be installed around the intake end of each existing and new siphon pipe. The individual siphons would be placed as close together as possible but would be spaced at least 40 feet apart to incorporate fish screen requirements. DW could use the existing reservoir island siphons for diversions to create shallow-water wetland habitat. In-line booster pumps would be available on the reservoir islands to supplement the siphon capacity during final stages of reservoir filling. Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives", includes a detailed description of the siphon unit design.

Pump Station Design. One discharge pump station would be located on each reservoir island (Figures 2-2 and 2-3). The pump stations would have 32 new pumps (on Webb Tract) or 40 new pumps (on Bacon Island) with 36-inch-diameter pipes discharging to adjacent Delta channels. Typical spacing for the pumps would be 25 feet on center. An assortment of axial-flow and mixed-flow pumps would be used to accommodate a variety of head conditions throughout drawdown. Actual rates of discharge of each pump would vary with the remaining pool elevations. As water levels decrease on the islands, the discharge rate of each pump also would decrease. Existing pump stations on the islands may be modified and used when appropriate to help with dewatering or for water circulation for water quality purposes. Appendix 2 includes a detailed description of the pump unit design.

Diversion and Discharge Operations. The DW project alternatives are designed to operate within the objectives of the 1995 WQCP and consistently with Corps requirements for maximum SWP exports. The following discussions define terms used to describe DW project operations in the context of Delta operations criteria; explain the criteria for diversions under Alternatives 1 and 2; describe the assumed operating criteria for discharges under Alternative 1; and describe the assumed criteria for discharges under Alternative 2, contrasting them with those for Alternative 1.

Definition of Terms. Following are definitions of several terms used below to describe the manner in which the project alternatives would operate relative to 1995 WQCP requirements and other conditions:

- **Export limits**. The 1995 WQCP specifies that Delta exports are limited to a percentage of total Delta inflow (generally 35% during February-June and 65% during July-January).

- **Outflow requirements**. The 1995 WQCP specifies Delta outflow requirements that encompass water quality protection for agricultural and municipal and industrial uses, Suisun Marsh, and fish habitat. In standard DWR calculations of Delta operations (using the water balance model known as "DWRSIM"), "outflow" represents the difference between inflow and exports; the outflow term used in this chapter therefore includes in-Delta consumptive use.

- **Available water**. Under the 1995 WQCP, available water is total Delta inflow less Delta outflow requirements.

- **Allowable export**. Water allowable for export under the 1995 WQCP is the lesser of the amount specified by the export limits (i.e., percentage of total Delta inflow) and the amount remaining after outflow requirements are met (i.e., available water).

- **Physical export pumping capacity**. The SWP export pumps have a maximum physical pumping capacity of 10,300 cubic feet per second (cfs) and the CVP export pumps have a maximum physical pumping capacity of 4,600 cfs, for a combined physical export pumping capacity of 14,900 cfs. At times, the canal capacity for the CVP is reduced to 4,200 cfs, reducing the combined physical export pumping capacity to 14,500 cfs.

- **Permitted pumping rate**. The Corps does not require a permit under Section 404 of the Clean Water Act for current SWP export pumping. However, the Corps would require a permit if SWP export pumping were to exceed a maximum 3-day average rate of 6,680 cfs. Therefore, the maximum combined export pumping rate that does not require a Corps permit is 11,280 cfs (6,680 cfs for the SWP pumps and 4,600 cfs for the CVP pumps). The restrictions for the period of December 15 to March 15, as interpreted by DWR, allow a combined rate of 11,700 cfs in December and March and a combined maximum 3-day average rate of 12,700 cfs in January and February. For assessment of the DW project alternatives, it is assumed that the SWP and CVP pumps will always pump the maximum amount allowable (i.e., the lesser of available water and the amount specified by the export limits) within the limits of the permitted pumping rate.

- **Future permitted export pumping capacity**. In the future, new permit conditions may be established for the SWP, thereby allowing the permitted export pumping rate of the SWP pumps to be increased to the physical export pumping capacity of 10,300 cfs. If that occurs, the combined permitted export pumping rate of the SWP and CVP pumps could then equal up to 14,900 cfs or 14,500 cfs.

- **Actual exports**. Actual exports are the least of the following: the amount specified by the export limits (i.e., as percentage of inflow), available water (i.e., water available after outflow requirements are met), and permitted export pumping rate.

- **DW discharge for export**. DW may sell its stored and discharged water to buyers south or west of the Delta who would arrange to have the purchased water transported to areas of use through either the SWP or CVP aqueducts. The term "wheeling" is often applied to this process of transporting water owned by the purchasing entity through the SWP or CVP aqueducts.

Diversions under Alternatives 1 and 2. Under Alternatives 1 and 2, DW diversions are treated consistently with the 1995 WQCP objectives for Delta exports at the SWP and CVP pumping plants. That is, DW diversions are considered to be the same as SWP and CVP exports in complying with the WQCP objectives, although DW's applied-for water rights for diversions would have a lower priority than the senior SWP and CVP water rights.

DW direct diversions or diversions to storage could occur in any month, but would occur only when the volume of allowable water for export (i.e., the lesser of the amount specified by the export limits and the amount of available water) is greater than the permitted pumping rate of the export pumps. This would occur when two conditions are met: 1) when all Delta outflow requirements are met and 2) when the export limit is greater than the permitted pumping rate, so that water that is allowable for export is not being exported by the SWP and CVP pumps. Situations may exist, however, in which the SWP and CVP may not be pumping at capacity because of low demands during winter, maintenance activities, or other circumstances, but DW would still be able to divert water for storage.

Figure 2-5 shows two examples of months with opportunities for DW diversion to storage. The panel on the left shows a month with 40,000 cfs of total Delta inflow when the export limit is 35% of inflow and when required outflow is 7,000 cfs. The permitted pumping rate of 11,280 cfs limits CVP and SWP exports to less than the export limit of 14,000 cfs (35% of 40,000 cfs), providing an opportunity for DW diversions of 2,720 cfs (14,000 cfs - 11,280 cfs).

The panel on the right in Figure 2-5 illustrates a month with total inflow of 20,000 cfs when the export limit is 65% of inflow (13,000 cfs) and when required outflow is 4,000 cfs. In this month also, CVP and SWP exports are limited by permitted pumping rate, so that DW has an opportunity to divert 1,720 cfs, the difference

between the export limit and the permitted pumping rate (13,000 cfs - 11,280 cfs).

Current and applied-for water rights for the reservoir islands and their proposed uses are discussed below under "DW's Existing and Pending Water Rights".

Discharges under Alternative 1. For Alternative 1, the EIR/EIS analysis assumes that discharges of water from the DW islands would be exported in any month when unused capacity within the permitted pumping rate exists at the SWP and CVP pumps and strict interpretation of the export limits (percentage of total Delta inflow, or "percent inflow") specified in the 1995 WQCP does not prevent use of that capacity. Such unused capacity could exist when the amount of available water (i.e., total inflow less Delta outflow requirements) is less than the amount specified by the export limits.

Figure 2-6 presents an example of DW discharges for export under this alternative. In the example, total Delta inflow is 20,000 cfs in a month with an export limit of 35% of inflow, or 7,000 cfs. The outflow requirement is 14,000 cfs, leaving only 6,000 cfs of available water (20,000 cfs - 14,000 cfs). The difference between the 35% export limit and the available water (7,000 - 6,000 = 1,000 cfs) could present an opportunity for export of DW releases.

Under this alternative, DW discharges would be treated as additions to total Delta inflow. Export of DW discharges thus would be limited to the lesser of the permitted export pumping capacity and the amount calculated under the "percent inflow" export limit, based on the adjusted inflow amount (20,000 cfs + DW additions to inflow). For example, if DW water is released and exported at the DW maximum monthly average discharge rate of 4,000 cfs, the adjusted total Delta inflow would be 24,000 cfs and the adjusted export limit would be 8,400 cfs (35% of 24,000 cfs). With this adjusted export limit, the opportunity for DW discharge for export would be 2,400 cfs (8,400-cfs export limit - 6,000 cfs of available water). The remainder of the 4,000-cfs DW discharge (1,600 cfs) would be added to Delta outflow.

Under Alternative 1, DW has two choices regarding allocation of discharges. If DW chooses to discharge at the maximum DW discharge rate, some of the releases must be used to increase Delta outflow while the balance is exported, as shown in this example. Alternatively, DW could choose to limit discharges so that no allocation to Delta outflow is needed. In this same example, if DW were to release only 1,500 cfs, the adjusted inflow would be 21,500 cfs and the adjusted export limit would be 7,525 cfs (35% of 21,500 cfs), allowing the 1,500-cfs DW discharge to be exported, along with the 6,000 cfs of available water, without an allocation to Delta outflow.

Discharges under Alternative 2. Under Alternative 2, it is assumed that releases of water from the DW islands would be exported by the SWP and CVP pumps during any month when unused capacity within the permitted pumping rate exists at the SWP and CVP pumps. DW discharges would be allowed to be exported in any month when such capacity exists and would not be subject to strict interpretation of the export limits (percentage of total Delta inflow). It is assumed that Alternative 2, like Alternative 1, would operate in the context of current Delta facilities, demand for export, and operating constraints. Under this alternative, it is assumed that export of DW discharges is limited by the 1995 WQCP Delta outflow requirements and the permitted combined pumping rate of the export pumps but is not subject to strict interpretation of the 1995 WQCP "percent of inflow" export limit.

Figure 2-6 shows an example of an opportunity for DW discharge for export under this alternative. For the example month, total Delta inflow is 20,000 cfs when the export limit is 35% of inflow and when required outflow is 14,000 cfs. Total inflow less required outflow would leave 6,000 cfs available for export by the CVP and SWP. Maximum DW discharge of 4,000 cfs could be exported under this alternative, for a total Delta export of 10,000 cfs. The export limit of 7,000 cfs (35% of 20,000 cfs) would not limit export of the DW discharge.

Timing and Rate of Diversions onto the Reservoir Islands. The timing and volume of diversions onto the reservoir islands would depend on how much water flowing through the Delta is not put to reasonable beneficial use by senior water right holders or required for environmental protection and would be subject to operational terms and conditions of project approval. DW proposes to develop a procedure to coordinate DW project diversions with SWP and CVP operations on a daily basis to ensure that DW diversions capture only available Delta flows, satisfy 1995 WQCP water quality objectives, and maximize efficiency of the DW water storage operations.

Diversion rates of water onto the reservoir islands would vary with pool elevation and water availability. The maximum daily average rate of diversions onto either Webb Tract or Bacon Island would be 4,500 cfs (9 TAF per day) at the time diversions begin (i.e., when head differential [the pressure created by water within a given volume] between channel water elevation and the island bottom is greatest). The diversion rate would be reduced as the reservoirs fill and the head differentials diminish.

Booster pumps would be used to complete the filling process. The combined maximum daily average rate of diversion for all the islands (including diversions to habitat islands, described below) would not exceed 9,000 cfs. The combined maximum monthly average diversion rate would be 4,000 cfs; at this average rate, both reservoir islands could be filled in approximately one month.

Estimated mean monthly diversions under Alternatives 1 and 2 are shown in Table 2-2. This table presents an overview of estimated DW project operations but does not show the pattern of estimated operations, which includes values that vary widely from the average values. Appendix 2 presents monthly percentiles of diversions under Alternatives 1 and 2.

Timing and Rate of Discharges from the Reservoir Islands. DW proposes to discharge stored water from the reservoir islands during periods of demand in any month, subject to Delta regulatory limitations and export pumping capacities. Discharges would be pumped at a combined maximum daily average rate of 6,000 cfs. The combined monthly average discharge rate of the reservoir islands, however, would not exceed 4,000 cfs; at this average rate, both reservoir islands could be emptied in approximately one month. The pump station pipes would discharge underwater to adjacent Delta channels.

Estimated mean monthly discharges from the reservoir islands under Alternatives 1 and 2 are shown in Table 2-2. Appendix 2 presents monthly percentiles showing simulated patterns of operations under the DW project alternatives.

Levee Improvements and Maintenance

For operation of Alternatives 1 and 2, the perimeter levees on the DW reservoir islands would be improved to bear the stresses and erosion potential of interior island water storage and drawdown. DW would raise and widen the perimeter levees on the reservoir islands to hold water at a maximum elevation of +6 feet. Levee improvements would be designed to meet or exceed state-recommended criteria for levees outlined in DWR Bulletin 192-82 (DWR 1982). Levee design would address control of wind and wave erosion through placement of rock revetment on the inside slopes of the perimeter levees and control of project-related seepage through an extensive monitoring and control system.

DW would implement a monitoring and maintenance plan for the improved perimeter levees on the reservoir islands. During project operation, the perimeter levees would be inspected weekly to indicate any erosion, cracking, or seepage problems. Ongoing maintenance activities on the levees would include, but are not limited to, placement of fill material, placement or installation of erosion protection material, reshaping or grading of fill material, herbicide application, selective burning, and regrading or patching of the levee road surface.

Shallow-Water Management on the Reservoir Islands

Incidental to project operations, Alternatives 1 and 2 could include shallow-water management on Bacon Island and Webb Tract to enhance forage and cover for wintering waterfowl when water would not be stored on the reservoir islands. As discussed in Chapters 3G, "Vegetation and Wetlands", and 3H, "Wildlife", DW would not be required to create wetland habitat on the reservoir islands to compensate for impacts on wildlife or wetland resources resulting from water storage operations; compensation habitat is provided on the habitat islands under the HMP (see "Summary of the Habitat Management Plan" below). Creation of wetland habitat on the reservoir islands would be implemented at DW's discretion.

DW would construct and maintain an inner levee system on the bottoms of the reservoir islands. The system would consist of a series of low-height levees and connecting waterways and would manage shallow water during periods of nonstorage. The inner levees would be broad earthen structures similar to the structures currently in place on existing farm fields. Appendix 2 includes details on levee design and borrow sites for levee improvement materials. More detail regarding levee design and maintenance is presented in Chapter 3D, "Flood Control".

When water is not being stored on the reservoir islands, the islands could be flooded to shallow depths (approximately 1 acre-foot of water per acre of wetland) for creation of wetland habitat, typically 60 days after reservoir drawdown. During years of late reservoir drawdown, additional time may be necessary before shallow flooding begins to allow seed crops to reach maturity. Once shallow flooding for wetland management occurred, water would be circulated through the system of inner levees until deep flooding occurred or through April or May. If the reservoir islands were not deeply flooded by April or May, water in seasonal wetlands would be drawn down in May, and if no water were available for storage, the island bottoms would remain dry until September, when the cycle would potentially repeat. Incidental to the shallow-water management, DW could potentially sell

that water when it was drawn down in April or May. DW's current and applied-for water rights for the reservoir islands and their proposed uses under Alternatives 1 and 2 are described below under "DW's Existing and Pending Water Rights".

Recreation Facilities

Water storage operations on Bacon Island and Webb Tract would not preclude recreation on those islands. DW proposes to construct a maximum of 11 recreation facilities on each of these islands along the perimeter levees, as shown in Figures 2-2 and 2-3. Each recreation facility would be constructed on approximately 5 acres and would include living quarters with a maximum of 40 bedrooms, a 30-berth floating dock with a gangway that provides access from neighboring water channels, a 36-berth floating dock on the interior of the island to provide small-boat access to hunting areas, and a 40-car parking lot located along the levee crest access road. Appendix 2 describes the proposed recreation facilities in more detail.

DW Environmental Research Fund

The DW project, once operating, would contribute $2 per acre-foot of water sold for Delta export to a research fund established to sponsor related research work. No monies from the fund will be allocated to fulfill project permit requirements. Rather, it is intended that the fund pay for research in those areas that may be affected by the DW project and in other areas in the Delta.

The fund would be administered by DW, and an invited committee would be established to decide how research funds would be allocated. The committee will likely include representatives from the California Department of Fish and Game (DFG), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), SWRCB, DW, fishery-oriented and waterfowl-oriented organizations, and one general environmental organization.

Operations and Maintenance

Operation and maintenance activities for the reservoir islands under Alternatives 1 and 2 would include:

- operation of onsite siphons and pumps during water diversions and discharges;
- inspections and maintenance of perimeter levees, including placement of fill and rock revetment as needed;
- maintenance of inner levees for shallow-water management and management of reservoir bottoms;
- maintenance and monitoring of siphon units and fish screens;
- inspections and maintenance of pump and siphon stations; and
- maintenance and operation of recreation facilities performed by seasonal employees.

Other operation and maintenance measures required by water rights or other permits and agreements (including proposed mitigation measures) are described for each resource area in Chapters 3A through 3O.

Habitat Islands

Bouldin Island and Holland Tract would be managed for wetlands and wildlife habitat under Alternatives 1 and 2 (Figures 2-7 and 2-8). An incidental operation of the habitat islands may involve the sale or use of water required to be drained from the islands. This water would be sold or used for the same purposes as the water discharged from the reservoir islands.

The primary function of the habitat islands, as described in the HMP, is to offset the effects of water storage operations on state-listed threatened and endangered species, waters of the United States (including wetlands) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, other wildlife habitat areas, and wintering waterfowl. The habitat islands would be developed and managed to provide breeding and foraging habitat for special-status wildlife species and other important wildlife species groups. The amounts and types of wetlands and other habitats developed on the habitat islands would compensate for the impacts of project facility construction and water storage operations on the reservoir islands and any impacts associated with construction and operation of the habitat islands.

Wetland management on the habitat islands would require grading areas, revegetating, and diverting water. As part of Alternatives 1 and 2, improvements would be made to existing siphon and pump facilities and to peri-

meter levees, including levee buttressing to meet DWR's recommended standards for levee stability and flood control. Figure 2-9 depicts conceptual cross sections of Bouldin Island and Holland Tract under fall management conditions when seasonal wetlands are flooded. No new siphon or discharge pump stations would be constructed on the habitat islands. Recreation facilities would be constructed on the habitat island perimeter levees, and the Bouldin Island airstrip would be operated to support maintenance and recreational activities on the DW project islands.

Summary of the Habitat Management Plan

The HMP was developed to describe how the habitat islands will be managed to provide for wetlands and wildlife habitat to offset acreage affected by operation of the DW project. Also incorporated into the HMP were provisions for best land management practices to benefit wildlife species other than those special-status target species specifically addressed by the HMP. The HMP specifically describes goals and objectives for wildlife habitat management, habitat design and function, guidelines for habitat and recreation management, and procedures for ensuring short- and long-term success of project compensation. Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands", contains detailed descriptions of the components of the HMP.

The HMP was developed by a team consisting of representatives of DFG, SWRCB, and JSA, in consultation with the Corps and USFWS. DW worked with the HMP team prior to preparation of this EIR/EIS to incorporate the HMP into DW's proposed project. The HMP team designed island habitats, habitat juxtaposition, and habitat management guidelines to achieve the following goals, which are listed in order of descending priority:

- Compensation goals: compensate for water storage operation effects on Swainson's hawk and greater sandhill crane, species listed as threatened or endangered under the California Endangered Species Act; wintering waterfowl habitat; and wetlands, as regulated by the Corps, pursuant to Section 404 of the Clean Water Act.

- Species goals: without compromising compensation goals, implement best land management practices to benefit upland wildlife species; enhance waterfowl breeding habitat, greater sandhill crane roosting habitat, and Swainson's hawk nesting habitat; and provide habitats for other special-status species.

- Other important goals: propose best land management practices that do not detract from compensation and priority species goals to enhance habitat conditions for other important species or species groups, such as migratory shorebirds, nongame water birds, and species associated with riparian habitats.

See Chapter 3G, "Vegetation and Wetlands"; Chapter 3H, "Wildlife"; and associated appendices for more information on the HMP and on the effects of water storage operations.

Habitat Island Diversions and Discharges

Bouldin Island and Holland Tract would be managed for improvement and maintenance of wetland and wildlife values. The timing and volumes of diversions onto the habitat islands would depend on the needs of wetlands and wildlife habitat. Wetland diversions would typically begin in September and water would be circulated through winter. Existing siphons would be used for diversions to the habitat islands. Fish screens would be installed on all siphons used for diversions.

The maximum rate of proposed diversions onto Holland Tract and Bouldin Island would be 200 cfs per island. Diversions onto the habitat islands would not cause the combined maximum daily average diversion rate of 9,000 cfs for all four DW project islands to be exceeded. The estimated water budget for the habitat islands is presented in Appendix A1, "Delta Monthly Water Budgets for Operations Modeling of the Delta Wetlands Project". Water would be applied to the habitat islands in each month for management of acreages of open water and perennial wetlands, flooded seasonal wetlands, and irrigated croplands specified in the HMP. Approximately 19 TAF would be diverted annually onto the habitat islands.

Water would be discharged from the habitat islands based on wetland and wildlife management needs. Typically, water would be drawn down by May and the habitat islands would remain dry until September, except for permanent water areas and other areas kept wet because of vegetation needs. Existing pumps would be used for discharges and for water circulation on the habitat islands. If new appropriative rights were approved for the water diverted onto the islands for wetland and wildlife management needs, DW could potentially sell that water when it is discharged; however, such discharge will not conflict with the HMP.

The maximum rate of proposed discharges from Bouldin Island and Holland Tract would be 200 cfs per island. Discharges from the habitat islands for export would not cause the combined maximum daily average discharge rate of 6,000 cfs and the maximum average monthly rate of 4,000 cfs for all four DW project islands to be exceeded.

Levee Improvements and Maintenance

Levee improvements on the habitat islands would be designed, at a minimum, to meet criteria for levees outlined in DWR Bulletin 192-82 (DWR 1982). Routine maintenance activities on habitat island perimeter levees would not differ from current practices and would include replenishing riprap, placing fill material, placing gravel, reshaping fill material, grading, disking, mowing, selectively burning, controlling rodents, and installing rock revetment. Interior slopes of perimeter levees on the habitat islands would be planted with grass to resist erosion from rainfall and would be maintained according to current practices. In accord with the HMP, borrow material for levee improvement and maintenance would be extracted at designated locations from the island interiors before the beginning of habitat development and intermittently as needed thereafter. More detail regarding levee design and maintenance is presented in Chapter 3D, "Flood Control".

Water Management Facilities for Habitat Creation

Water would be diverted to and discharged from the habitat islands with existing facilities, with newly installed fish screens on the siphons for diversions (Figures 2-7 and 2-8). See Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives", and Appendix F2, "Biological Assessment: Impacts of the Delta Wetlands Project on Fish Species", for details on fish screen design.

Recreation Facilities

Recreation facilities on the habitat islands would be similar to those described above for the reservoir islands. Consistent with the HMP, DW would construct up to 10 new recreation facilities on Bouldin Island and six new recreation facilities on Holland Tract. The HMP designates open hunting areas for waterfowl and upland hunting, as well as closed zones where hunting is prohibited. The HMP allows for waterfowl hunting in areas consisting of approximately 50% free-roam hunting zones (average of one hunter per 60 acres) and 50% spaced-blind hunting zones (one fixed-location blind with a maximum occupancy of four hunters per 50 acres). No waterfowl or upland bird hunting or other human disturbance (e.g., birdwatching or dog training), except monitoring, maintenance, and other activities consistent with implementation of the HMP, would be permitted in designated closed zones.

Waterfowl hunting would be permitted only on Saturdays, Sundays, and Wednesdays and on two additional days (subject to the restriction that, in any event, hunting would not be permitted on more than 3 consecutive days) to be designated by the hunting program manager prior to the opening of waterfowl season. Hunting of upland birds (i.e., pheasants and doves) would be permitted on Saturdays, Sundays, and Wednesdays during waterfowl season and during the break between the first and second halves of the waterfowl season. No hunting beyond that described above and in Chapter 3J, "Recreation and Visual Resources", would be permitted on the DW project islands.

The Bouldin Island airstrip will be available for use by hunters and other recreationists to fly to the island. To reduce disturbances to wildlife, restrictions specified in the HMP have been placed on operation of fixed-wing aircraft and helicopters in the habitat island areas. From September 1 through March 31, use of the airstrip for flights related to habitat management activities would be limited to 4 days per week. During the waterfowl hunting season (generally October 1 through January 2), use of the airstrip for habitat management activities would be limited to nonhunt days. During this season, use of the airstrip by fixed-wing aircraft for purposes other than habitat management (e.g., recreational use) would be limited to 100 landings and takeoffs (a landing and a takeoff in combination are counted as one). On hunt days, these flights would be allowed only between 12:00 p.m. and 2:00 p.m. Helicopters would be permitted to land on perimeter levees in the recreation areas and would be required to approach the landing areas from outside the island; helicopters would not be permitted to fly over the habitat islands. No restrictions on use of the airstrip would be required during other times on the year.

Operations and Maintenance

Operation and maintenance activities for the habitat islands under Alternatives 1 and 2 would include:

- operation and routine maintenance of the siphon and pump units;

- management of habitat areas, including, but not limited to, the control of undesirable plant species, agricultural plantings and irrigation, and the maintenance or modification of inner levees, circulation ditches, canals, open water, and water control structures to facilitate flooding and drainage;
- maintenance and monitoring of fish screens during water diversions for habitat maintenance;
- wildlife and habitat monitoring for the HMP;
- inspections and maintenance of perimeter levees;
- use of the Bouldin Island airstrip for seed dispersal and application of herbicides and other pesticides;
- operation of recreation facilities; and
- monitoring and enforcement of hunting restrictions.

Other operation and maintenance measures required to mitigate impacts associated with the DW project are described for each resource area in Chapters 3A through 3O.

DW's Existing and Pending Water Rights

Current Water Rights

DW has existing appropriative water rights for each of the four DW project islands for direct diversion from March 1 through November 1 annually. These rights have a priority date of July 28, 1922, and have been licensed. These appropriative rights are the primary basis of right to divert and use water for the current agricultural activities on each of the islands.

DW also claims riparian rights, which may be used when there is riparian water available in the Delta and there is need to divert water outside the season of diversion specified for the existing appropriative water rights or for uses other than irrigation. Riparian rights have been used as a secondary basis of right on all four DW project islands for many years. Tables 2-3 and 2-4 provide a detailed summary of these existing water rights and pending water right applications for the DW project.

Under the DW project, these rights could not be used independently to fill the reservoir islands.

Proposed Uses of Water

The following section describes the proposed uses of water on the two reservoir islands (Webb Tract and Bacon Island) and the two habitat islands (Bouldin Island and Holland Tract) under DW's existing and applied-for water rights. The description applies to Alternatives 1 and 2, DW's proposed project.

Reservoir Islands (Webb Tract and Bacon Island). The primary basis of water rights for DW's proposed reservoir operations will be storage and direct diversion rights under Applications 29062 and 30268 for Webb Tract and Applications 29066 and 30270 for Bacon Island.

The existing licensed rights may be used for irrigation of habitat cover crops on the reservoir islands, particularly during drier years, when water may be available under the terms of the existing licenses and not under those of the new applications. Also, when water is available for use under riparian rights, riparian claims could be exercised for seasonal wetland habitat use on the reservoir islands, for irrigation, or for diversions for other legal uses outside the licensed season. To allow for the sale of water previously diverted onto the reservoir islands under existing rights, DW filed petitions to add additional points of diversions under Applications 30268 and 30270 at the location(s) on the islands where water otherwise would be discharged during reservoir operations. Approval of the petitions would allow the reappropriation of water already on the reservoir islands at the rate(s) up to the discharge pump capacities. If the petitions are approved, DW could appropriate seepage, return flow from cover crop irrigation under Licenses 1572 and 1321 (Applications 2952 and 2954), and surplus wetland water diverted under riparian claim when surplus water is available under Applications 30268 and 30270. The existing licenses or riparian claims could be used in dry years for on-island beneficial uses until sufficient surplus is available for normal reservoir storage operations or until water transfer parking options develop later in a dry year.

DW has applied for both storage and direct diversion rights under the applications filed in 1987 and 1993 for both reservoir islands. The quantities, purpose(s) of use, and seasons of diversion are shown in Table 2-3. The quantities are sufficient to allow multiple filling and emptying of the reservoir islands when there is sufficient available water. Any permits issued will include special

terms and conditions and specify the required accounting procedure(s) needed to identify the timing of appropriations and amount of water allowed to be appropriated under the applications.

Habitat Islands (Bouldin Island and Holland Tract). Table 2-4 shows current and proposed water rights for Bouldin Island and Holland Tract. The licensed appropriative water rights will continue to be the primary basis of right for irrigation of habitat cover crops on the DW project islands. Riparian claim will be exercised as the basis of right for wetland habitat use and when irrigation or diversions for other legal uses are required outside the licensed season. Both types of right will be needed under the HMP, which calls for irrigation of cover crops and sequential flooding of seasonal wetland habitat ponds beginning in September and continuing through December. Supplemental water will be added as required to replenish water lost through evaporation, evapotranspiration (ET), and seepage. The HMP requires that seasonal wetlands be drained each year for forage crops to be grown.

DW has requested that water diverted onto the habitat islands be available for later sale if consistent with HMP requirements. This incidental use of the habitat islands cannot occur under the existing water rights. Therefore, DW filed petitions to add additional points of diversion under Applications 30267 and 30269. Approval of the petitions would allow the reappropriation of water on the habitat islands at the rate(s) at which, and the locations where, seepage or return flows would otherwise be discharged from the islands. If the additional points of diversion are approved, DW could appropriate seepage, return flow from cover crop irrigation under Licenses 1405 and 1571 (Applications 2948 and 2951), and surplus wetland water diverted under riparian claim when surplus water is available in the Delta under Applications 30267 and 30269. DW has requested that SWRCB approve the petitions along with the pending applications.

Any SWRCB approval of the petitioned diversion points on the habitat islands will specify the required accounting procedure(s) needed to identify when water on the habitat islands could be reappropriated under Application 30267 or 30269 and be available for sale. Only discharged water taken under riparian right would be abandoned (i.e., would not be available for sale).

DESCRIPTION OF ALTERNATIVE 3

Under Alternative 3, all four DW project islands would be managed for year-round diversion and storage of water. This alternative represents the maximum water appropriations that would be achieved by SWRCB granting DW's water right applications. This alternative also represents the maximum amount of water storage that would be feasible on the four project islands based on levee height and internal elevation. Project operations under this alternative would be the same as those under Alternative 2 with respect to diversion and discharge operations (except for diversion and discharge rates) and construction and operation of recreation facilities; however, this alternative would allow year-round water diversions on all four DW project islands and would require substantially greater investments in internal levee construction to protect State Route (SR) 12 on Bouldin Island.

Operations on Bacon Island and Webb Tract would be the same as those described for Alternative 2 and shown in Figures 2-2 and 2-3. Bouldin Island and Holland Tract would be operated for water storage similar to Webb Tract and Bacon Island, rather than for wetland habitat creation; proposed locations for water storage facilities on Bouldin Island and Holland Tract are shown in Figures 2-10 and 2-11. Alternative 3 would include the area on Holland Tract excluded from the project area under Alternatives 1 and 2 but would not preclude the operation of the marinas located on the channel side of Holland Tract's southern perimeter levee. According to DW, landowners of the Holland Tract area not now owned by DW have been contacted, and DW would be able to purchase the area if Alternative 3 were implemented. Under Alternative 3, a habitat reserve (the North Bouldin Habitat Area [NBHA]) would be created north of SR 12 on Bouldin Island to compensate for some of the impacts associated with water storage operations. Additional offsite wildlife habitat and wetland compensation would be required for this alternative.

Water Storage Operations

The four reservoir islands would be designed for water storage levels up to a maximum pool elevation of +6 feet relative to mean sea level (based on National Geodetic Vertical Datum data), with a total initial capacity of 406 TAF allocated among the reservoir islands as follows: Bacon Island, 117 TAF; Webb Tract, 119 TAF; Bouldin Island, 98 TAF; and Holland Tract, 72 TAF. Water availability, permit conditions, and DSOD requirements may limit storage capacities and may result in a final storage elevation of less than +6 feet.

As described for Alternatives 1 and 2, the total physical storage capacity of the reservoir islands may

increase over the life of the project as a result of subsidence. Based on an estimated 0.5 inch of subsidence per year, it is estimated that the total storage capacity of the four reservoir islands after 50 years could be as much as 448 TAF.

The siphon and pump station designs for all four DW project islands would be the same as those described for the reservoir islands (Bacon Island and Webb Tract) under Alternatives 1 and 2. DW proposes to construct two intake siphon stations on each reservoir island with 16 new siphons each on Bacon Island and Webb Tract and 12 new siphons each on Bouldin Island and Holland Tract, for a total of 112 new siphons. One discharge pump station would be installed on each reservoir island, with 40 new pumps at both the Bacon Island and Webb Tract stations and 30 new pumps at both the Bouldin Island and Holland Tract stations, for a total of 140 new pumps. Locations of the proposed siphon and pump stations under Alternative 3 are shown in Figures 2-2, 2-3, 2-10, and 2-11.

The perimeter levees of all four reservoir islands would be buttressed and improved as described for Webb Tract and Bacon Island under Alternatives 1 and 2. Alternative 3 would require construction of a large interior levee across Bouldin Island along the south side of SR 12. Water storage operations south of SR 12 would require that the south-side levee, also known as Wilkerson Dam, be designed and constructed in accordance with DSOD standards where water would be stored in excess of +6 feet in elevation. Wilkerson Dam is described in Chapter 3E, "Utilities and Highways", and Appendix E1, "Design and Construction of Wilkerson Dam South of SR 12 on Bouldin Island".

Chapter 3A, "Water Supply and Water Project Operations", and Appendix A3, "DeltaSOS Simulations of the Delta Wetlands Project Alternatives", describe the simulated water budget for diversions, storage, and exports under Alternative 3.

Diversions onto the Reservoir Islands

The maximum daily average rate of proposed DW project diversions onto either Webb Tract or Bacon Island would be 4,500 cfs (9 TAF/day) and onto either Bouldin Island or Holland Tract would be 3,000 cfs (6 TAF/day) at the time diversions begin. If water were being diverted to multiple reservoir islands at the same time, the combined maximum daily average diversion rate of the islands would not exceed 9,000 cfs. The maximum monthly average diversion rate would be approximately 6,000 cfs, which would fill the four reservoir islands in one month. Estimated mean monthly diversions onto the reservoir islands under Alternative 3 are shown in Table 2-2.

Discharges from the Reservoir Islands

Discharge pumping would occur at a maximum rate of 4,000 cfs from Bacon Island and Webb Tract and 2,000 cfs from Bouldin Island and Holland Tract. The discharge rate for Bacon Island and Webb Tract would be greater than the rate for the other islands to allow rapid discharge from those islands. The maximum combined monthly average discharge rate of the reservoir islands, however, would depend on available export capacity but would be less than 6,000 cfs because the reservoir islands could be emptied in one month at this rate. The maximum daily average discharge rate is assumed to be 12,000 cfs. Estimated mean monthly discharges from the reservoir islands under Alternative 3 are shown in Table 2-2.

Habitat Management

Shallow-Water Management

Incidental to project operations, Alternative 3 could include shallow-water management to enhance forage and cover for wintering waterfowl when water would not be stored on the reservoir islands because of limits to water availability and increased demand for discharge. Each of the four reservoir islands would have an inner levee system for shallow-water management. Shallow-water management for Alternative 3 would be similar to that described for the reservoir islands under Alternatives 1 and 2.

North Bouldin Habitat Area

The portion of Bouldin Island north of SR 12 would be managed as the NBHA, a year-round riparian and wetland habitat area (Figure 2-10). The ground within the NBHA would be dredged and reshaped to provide year-round and seasonal water for habitat management. The NBHA would be bounded by a new interior levee north of SR 12 and by the island's perimeter levees. The north-side interior levee would not be subject to design review by DSOD. A new pump would be constructed in the NBHA for water discharges, and fish screens would be installed on existing siphons for water diversions.

Following are acreages of habitat types (totaling 875 acres) proposed for the NBHA:

- corn = 170 acres,
- perennial pond = 50 acres,
- riparian woodland = 200 acres,
- seasonal managed wetland = 313 acres,
- ditch = 17 acres,
- annual grassland = 29 acres, and
- fallow levee slope = 96 acres.

Additional offsite wildlife habitat compensation would be required for this alternative.

Recreation Facilities

Recreation facilities on Bacon Island and Webb Tract would be the same as those described for the reservoir islands under Alternatives 1 and 2. DW would construct up to ten and eight recreation facilities on Bouldin Island and Holland Tract, respectively, as shown in Figures 2-10 and 2-11. Operation and design of the recreation facilities for Alternative 3 would be similar to those described for the reservoir islands under Alternatives 1 and 2. No airstrip would be maintained under Alternative 3.

Operations and Maintenance

Operation and maintenance activities for the islands under Alternative 3 would be similar to those described for the reservoir islands under Alternatives 1 and 2. The NBHA would be managed similar to the habitat islands under Alternatives 1 and 2, but on a smaller scale.

DESCRIPTION OF THE NO-PROJECT ALTERNATIVE

If Corps permit applications or SWRCB water right permit applications for the DW project are denied, DW would implement intensive agricultural operations on the four project islands or sell the property to another entity that would likely implement intensive agriculture. The No-Project Alternative is based on the assumption that intensified agricultural conditions represent the most realistic scenario for the DW project islands if permit applications are denied. It is assumed that no new recreation facilities would be built.

Changes in project island operations under the No-Project Alternative would be limited to those farming activities that increase cropping intensity and could be implemented without a permit issued by the Corps or SWRCB. The No-Project Alternative would entail implementing more efficient drainage and weed management practices on Holland and Webb Tracts and shifting some crop types on Bacon and Bouldin Islands.

The DW island water budget terms for the No-Project Alternative are assumed to be approximately 50% higher than water budget terms under existing conditions, reflecting more extensive agricultural use of the islands; however, for modeling of water operations, this difference is not discernible and no distinction is made between the water budgets for existing conditions and the No-Project Alternative. The water budget for the No-Project Alternative is shown in Appendix A1, "Delta Monthly Water Budgets for Operations Modeling of the Delta Wetlands Project". Average monthly diversions for combined irrigation and salt leaching are shown in Table 2-2. Currently existing siphon facilities on the islands, which are unscreened, would not be modified under the No-Project Alternative.

WATER BUDGETS FOR THE DW ALTERNATIVES

By converting conventional agricultural land use to a combination of water storage and wildlife habitat management, the DW project would modify Delta water budgets. Table 2-1 summarizes differences in diversions, storage capacity, and discharges between the DW project alternatives. Table 2-2 shows the estimated mean monthly diversions from Delta channels to the DW project islands under Alternatives 1, 2, and 3 and the No-Project Alternative and mean monthly discharges for export or outflow from the DW project islands under Alternatives 1, 2, and 3. These tables present an overview of general differences between alternatives but do not show the detailed patterns of DW project operations, which include values that vary widely from the average values. Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives", provides a more detailed comparison of water storage operations under Alternatives 1, 2, and 3 in the form of monthly percentiles showing simulated diversions, end-of-month storage, and discharge amounts. Chapter 3A, "Water Supply and Water Project Operations", and Appendix A3, "DeltaSOS Simulations of the Delta Wetlands Project Alternatives", show details of the Delta water budget simulated under DW project operations as monthly percentiles and annual totals for each of the alternatives. Appendix 2 shows that

the pattern of water storage operations is generally characterized by large diversions and export amounts in small percentages of years.

COORDINATION WITH WATER RIGHTS, DELTA STANDARDS, AND FISH TAKE LIMITS

The project's permits, if granted by SWRCB, would contain terms and conditions to protect prior water right holders and the public interest and public trust. All existing and any future Delta standards regarding water quality, flows, and diversions would be applicable to the DW project alternatives as appropriate. The project permits would require that project diversions not interfere with the diversion and use of water by any other user with riparian or prior appropriative rights.

Coordination regarding Senior Water Rights

Most holders of riparian and senior appropriative water rights are located upstream of the Delta in the Sacramento or San Joaquin River Basins. Many holders of riparian rights are located in the Delta, and senior appropriative water rights are also held in the Delta by the SWP and the CVP, as well as Contra Costa Water District (CCWD) and several smaller diverters. The DW project would not interfere with diversions by these senior water right holders.

The DWR Division of Operations and Maintenance and Reclamation's Central Valley Operations Coordinating Office (CVOCO) maintain the official daily water budget estimates for the Delta and designate the Delta condition each day as being "in balance" or "in excess" relative to all SWRCB objectives and water right terms and conditions. The term "in balance" indicates that all Delta inflow is required to meet Delta objectives and satisfy diversions by CCWD, the CVP, the SWP, and Delta riparian and senior appropriative water users. Under all circumstances, when the Delta condition is designated to be in balance, no additional water would be available for diversion by the DW project under new water rights.

When DWR and CVOCO determine the Delta condition to be in excess and other terms and conditions are met, the DW project would be allowed to divert available excess water for storage on the designated reservoir islands under new appropriative water rights. DW diversions under existing riparian and senior appropriative rights may be permitted for shallow-water management, subject to applicable water right laws, even when the Delta is not determined to be in excess. The daily quantity of available excess water would be estimated according to DWR's normal accounting procedures. To provide extra protection for compliance with the 1995 WQCP, SWRCB may establish requirements for amounts of water within the designated excess water (i.e., buffers) that would not be available for DW diversions, or other measures to protect Delta objectives, existing water right holders, and public trust values. Nevertheless, during major runoff events, excess Delta inflow will likely be available for diversion by the DW project (see Chapter 3A, "Water Supply and Water Project Operations").

Coordination regarding Water Quality Standards

All existing and any future Delta water quality standards adopted by SWRCB or other regulatory agencies would be applicable to the proposed diversions. Project operations for water storage would not be allowed to violate applicable Delta water quality objectives and public trust values or interfere with the ability of other projects to meet the objectives.

The DW project permits would contain terms and conditions that specify the allowable project operations for a variety of possible Delta conditions related to water quality or fish and wildlife requirements. SWRCB terms and conditions for the requested DW water rights would specify DW operational rules and guidelines related to meeting applicable Delta objectives.

Coordination regarding Endangered Species

Under the federal Endangered Species Act, biological opinions would identify DW project operational criteria, take limits, and facility design (i.e., fish screen criteria) for winter-run chinook salmon, delta smelt, and possibly Sacramento splittail. The project permits would require that project operations fully comply with any applicable Endangered Species Act conditions and allowable take limits as specified in the biological opinions. Water exported from the DW reservoir islands will be subject to all applicable biological opinion requirements at the SWP and CVP export facilities.

ALTERNATIVES CONSIDERED BUT NOT SELECTED FOR DETAILED EVALUATION

EPA's Section 404(b)(1) guidelines prohibit discharges of dredged or fill material into waters of the United States if a practicable alternative exists that would have less adverse impacts on the aquatic ecosystem and that would not have significant adverse impacts on other biological resources. To comply with EPA's Section 404(b)(1) guidelines, the lead agencies initially considered a broad range of project alternatives that would meet the project purpose. This range was then narrowed to include only those alternatives that are reasonably foreseeable and technically and financially practicable for the applicant. The permitted project will constitute the least environmentally damaging practicable alternative for purposes of complying with Section 404 of the Clean Water Act. The 404(b)(1) alternatives analysis, provided in Appendix 4, gives additional detail.

This section describes alternatives considered for the project but not selected for detailed evaluation. The alternatives that were considered were not limited to water storage facilities in the Delta and included nonstructural and structural projects. Nonstructural alternatives are those that do not require construction of major new facilities. Structural alternatives are those that require construction of new facilities onsite or offsite.

Certain Delta programs and studies are not considered as alternatives to the DW project. These programs and studies relate to environmental conditions in the Delta and to the quantity and quality of available water supply in the Delta and therefore demonstrate the general public need for and benefit of additional water supply in the Delta. The related programs and studies are discussed in Appendix 2.

Reoperation of the CVP and the SWP

Under this alternative, DWR and Reclamation would further integrate and consolidate operations of the CVP and the SWP. Currently, the federal and state water projects operate their systems under different sets of rules. Integrating the CVP and the SWP would facilitate greater operational flexibility of the two systems and could facilitate improved water management throughout California's water system. A more efficient water system could result from better coordination of groundwater and surface water supplies and deliveries, and easier implementation of water conservation techniques, market-based water transfers, and groundwater management.

Reoperation of the CVP and the SWP, as described above, would require combined management of the CVP and the SWP to increase the operational flexibility of the two projects and therefore result in a more efficient water storage and delivery system.

This alternative could increase the supply of high-quality water in the Delta for sale for export south of the Delta or as Delta outflow to San Francisco Bay. However, this alternative has not been sufficiently defined to determine whether it could achieve the project purpose of increasing the supply of high-quality water in the Delta. It is presently impossible to estimate how much the combined management of the CVP and the SWP would contribute to increasing the quantity of high-quality water in the Delta.

Reoperation of the CVP and the SWP is not an available alternative to the project proponent. No role exists for a private participant in the management of an integrated CVP and SWP system. Financial implications of the reoperation of the CVP and the SWP are uncertain. The alternative could require substantial financial investments to evaluate, negotiate, plan, and implement CVP transfer and coordinated management of the two systems.

For the reasons stated above, reoperation of the CVP and the SWP was eliminated from further evaluation as a practicable alternative.

Water Conservation Alternative

Under this alternative, an entity (presumably governmental) would implement a water conservation program that would result in increased supplies of water in the Delta. Conservation measures for residential developments include retrofitting existing residences and constructing new developments with low-flow fixtures and appliances, relandscaping existing developments and landscaping new developments with drought-tolerant plants, and installing drip irrigation systems. Conservation measures for commercial and industrial uses include landscaping with drought-tolerant plants to reduce irrigation to a minimum, retrofitting existing structures, constructing new developments with low-flow fixtures, recycling water, and repairing leaks. Conservation measures for agriculture include furrow irrigation techniques, irrigation management, and irrigation system assessment.

DWR (1994) estimated that urban and agricultural water conservation programs might achieve 3 MAF of demand reduction statewide by 2020. This demand reduction was accounted for in the DWR (1994) projections for long-term California water demand. It is not possible to estimate the extent to which a reduction in California water demand would reduce demand in the Delta watershed, or how a reduction in demand in the Delta might contribute to increased Delta water supply. Therefore, the water conservation alternative cannot be defined sufficiently to support the conclusion that it would be able to satisfy the project purpose.

Water conservation, on a very small scale, is available to the project applicant. DW could implement water conservation efforts for intensified agricultural uses on its four Delta islands, but these efforts would not generate a measurable supply of water for sale for export or outflow. Conservation on a scale broad enough to have the potential to supply a minimum amount of water would require public, institutional, local agency, private industry, and agricultural community participation and would therefore be unavailable as a project alternative to DW.

For the reasons stated above, the water conservation alternative was eliminated from further evaluation as a practicable alternative.

Water Transfers Alternative

The water transfers alternative would consist of voluntary, market-based temporary and long-term water transfers directly using the Delta. The voluntary transfer of water has the potential to be an important means of achieving better water management in California. The California Legislature has declared that the established policy of the state is to facilitate voluntary water transfers and has directed DWR, SWRCB, and all other state agencies to encourage voluntary water transfers (California Water Code Sections 109 and 475).

Voluntary, market-based temporary and long-term water transfers directly using the Delta could increase the supply of high-quality water in the Delta for sale for export and/or outflow. Although DW could act as a type of broker for potential suppliers and buyers of market water, the feasibility of this role is highly speculative. The role DW would play in this alternative is not defined clearly enough to allow proper evaluation of the financial feasibility of DW being a broker in the water transfer market. A broker may not have a financially feasibly role in the water transfer market if suppliers and buyers contract directly with each other without the aid of a broker.

Water transfers can be short term (1 year or less) or long term. Many short-term water transfers were implemented through the State Drought Water Bank in 1991 and 1992 (DWR 1994). Short-term transfers are typically based on fallowing of irrigable agricultural land for short periods or on temporary shifts of supplies not needed by the seller on an interim basis. Long-term transfers that could increase water supply to the Delta are not sufficiently definable to be considered a practicable alternative to meet the project purpose. Because of the temporary or interim nature of these transfers, they cannot achieve the basic project purpose of providing a long-term increase in Delta water supply.

As stated above, the water transfers alternative was eliminated from further evaluation as a practicable alternative because:

- it would not realistically be available to the project proponent,
- it is not definable as a program of long-term transfers to increase Delta water supply,
- temporary transfers cannot meet the long-term project purpose, and
- the alternative may have limited financial feasibility for DW as a participant.

Non-Delta Water Storage or Conjunctive Use

Non-Delta water storage entails the construction of storage facilities with the capacity to store high-quality water for uses compatible with the DW project purpose. Such storage facilities could include surface water storage reservoirs or groundwater storage basins. Such facilities also could be operated conjunctively to improve overall supply reliability.

Agencies that are responsible for municipal, regional, state, and federal water systems are presently considering non-Delta options for offstream storage between the Delta and places of use (e.g., Los Banos Grandes Reservoir; Kern Water Bank; and Domenigoni Reservoir and the Los Vaqueros Project, which are under construction). These entities are also pursuing several options for conjunctive use of groundwater basins to produce drought-year water supplies. (DWR 1994.)

Under this alternative, a water storage facility could be constructed and operated to increase the long-term

supply of high-quality water in the Delta. Similarly, a conjunctive use program could be developed to increase Delta water supplies in drought years.

Conjunctive use programs require sponsorship and direction by regional water districts that coordinate management of large areas of irrigated farmland and defined groundwater basins in combination with centralized points for surface water diversions. Therefore, a conjunctive use water management program does not appear to be available to the project proponent. Furthermore, a conjunctive use program upstream of the Delta would not increase Delta water supplies over the long term but could increase Delta inflows in dry years.

As stated above, this alternative was eliminated from further evaluation as a practicable alternative for the following reasons:

- definable options that might be implemented under this alternative by 2020 are not available to the project proponent,
- other options require extensive investigation to determine their financial feasibility or their compatibility with a long-term Delta solution and thus are not currently definable, and
- conjunctive use programs might increase Delta water supplies only in drought years and are not available to the project proponent.

Water Storage on Other Delta Islands

This alternative could include using any number of the islands in the Delta other than DW's Bacon and Bouldin Islands and Holland and Webb Tracts to provide water storage for later sale for export or outflow. The facilities and operations used for this alternative would be similar to those described for Alternatives 1 and 2. However, because operation of the islands is, to some extent, a function of their geographic location, operations and facilities on other Delta islands may be very different from those proposed under Alternative 1, 2, or 3.

Although this alternative was generally available to the project proponent at the time of initial project planning, specific islands were unavailable and certain factors particular to each Delta island affect the financial feasibility of using an island as a potential site for water storage. Therefore, this alternative was eliminated from evaluation as a practicable alternative.

CITATIONS

California. Department of Water Resources. 1982. Delta levees investigation. December. (Bulletin 192-82.) Sacramento, CA.

_____. Department of Water Resources. 1993. Sacramento-San Joaquin Delta atlas. Sacramento, CA.

_____. Department of Water Resources. 1994. California water plan update. October. (Bulletin 160-93.) Sacramento, CA.

Table 2-1. Comparison of Alternative DW Project Operations

Alternative	Combined Reservoir Storage Capacity (TAF)	Mean Annual Diversion (TAF)	Limits to Discharges	Mean Annual Discharge (TAF)
1	238	222	1995 WQCP Delta outflow requirements; permitted combined SWP and CVP pumping rate; 1995 WQCP export limits as "percentage of total Delta inflow diverted"	188
2	238	225	1995 WQCP Delta outflow requirements; permitted combined SWP and CVP pumping rate	202
3	406	356	1995 WQCP Delta outflow requirements; permitted combined SWP and CVP pumping rate	302

Notes: TAF = thousand acre-feet.

Mean annual diversion and discharge values are derived from simulations of DW project operations based on the historical hydrologic record for 1922-1991 and assuming current Delta standards (see Chapter 3A, "Water Supply and Water Project Operations", and Appendix A3, "DeltaSOS Simulations of the Delta Wetlands Project Alternatives"). Mean annual diversion and discharge quantities do not include the small amounts of incidental water storage available from the habitat islands, estimated to be approximately 17 TAF annually.

C-060406

Table 2-2. Estimated Mean Monthly Diversions and Discharges under the DW Project Alternatives (TAF)

	October	November	December	January	February	March	April	May	June	July	August	September	Annual
Diversions													
Alt. 1	39	41	31	42	24	13	1	2	1	3	1	22	222
Alt. 2	39	41	31	40	24	14	5	2	1	3	1	22	225
Alt. 3	61	68	59	60	42	20	7	3	1	5	1	26	356
No-Project Alternative	2	0	3	3	3	0	0	3	13	16	12	6	60
Existing conditions	1	0	1.5	1.5	1.5	0	0	1.5	6.5	8	6	3	30
Discharges													
Alt. 1	0	1	13	2	10	5	12	16	8	56	49	18	188
Alt. 2	0	1	11	3	37	27	5	17	46	30	18	5	202
Alt. 3	0	1	11	4	43	42	5	17	70	48	48	11	302

Notes: Values for Alternatives 1, 2, and 3 are derived from simulations of DW project diversions to reservoir storage based on the historical hydrologic record for 1922-1991 and assuming current Delta standards (see Chapter 3A, "Water Supply and Water Project Operations", and Appendix A3, "DeltaSOS Simulations of the Delta Wetlands Project Alternatives"). Habitat island diversions are not included.

Values for the No-Project Alternative represent average combined diversions for irrigation and salt leaching estimated for intensified agricultural use of the DW project islands (see Appendix A1, "Delta Monthly Water Budgets for Operations Modeling of the Delta Wetlands Project").

The annual simulated patterns of DW project operations vary widely from these average values. See Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives", for monthly percentiles.

Annual values may not total correctly because of rounding.

Table 2-3. Existing and Proposed DW Water Rights for Reservoir Islands

Island/Tract	Water Right Type	Nature of Right	Application No./ Priority	Permit No.	License No.	Current Use	Proposed Future Use	Season of Diversion	Quantity[a]	Comments
Webb Tract	Appropriative	Direct diversion	2952 1922 priority	1416	1572	I	I	March 1- November 1	63.94 cfs	Primary right
	Riparian	Direct diversion	N/A	N/A	N/A	Ag	Ag/FWPE	N/A	Undefined	Secondary right
	Appropriative	Storage	29062 1987 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	December 15- May 1	106,900 af	
	Appropriative	Direct diversion	30268 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	3,000 cfs[b] 262,000 af[c]	
	Appropriative	Storage	30268 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	155,000 af	Petition to add on-island point of diversion for storage pending
Bacon Island	Appropriative	Direct diversion	2954 1922 priority	1418	1321	I	I	March 1- November 1	60.16 cfs	Primary right
	Riparian	Direct diversion	N/A	N/A	N/A	Ag	Ag/FWPE	N/A	Undefined	Secondary right
	Appropriate	Storage	29066 1987 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	December 15- May 1	110,570 af	
	Appropriative	Direct diversion	30270 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	3,000 cfs[b] 258,000 af[c]	
	Appropriative	Storage	30270 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	147,000 af	Petition to add on-island point of diversion for storage pending

Notes:
Ag = agricultural.
D = domestic.
I = irrigation.
M&I = municipal and industrial.
FWPE = fish and wildlife preservation and enhancement.
WQ = water quality.
af = acre-feet.
cfs = cubic feet per second.
N/A = not applicable.

[a] The maximum potential annual diversion for each island is the sum of the 1987 priority and the 1993 priority (see Appendix 1, "SWRCB Public Notice for the Delta Wetlands Water Right Applications"); the actual diversions for the project would likely be substantially less than the maximum amount.

[b] 30-day average rate of diversion.

[c] Annual maximum amount.

C-060408

Table 2-4. Existing and Proposed DW Water Rights for Habitat Islands

Island/Tract	Water Right Type	Nature of Right	Application No./ Priority	Permit No.	License No.	Current Use	Proposed Future Use	Season of Diversion	Quantity[a]	Comments
Bouldin Island	Appropriative	Direct diversion	2948 1922 priority	1412	1405	I	I	March 1- November 1	71.56 cfs	Primary right
	Riparian	Direct diversion	N/A	N/A	N/A	Ag	Ag/FWPE	N/A	Undefined	Secondary right
	Appropriative	Storage	29061 1987 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	December 15- May 1	96,070 af	
	Appropriative	Direct diversion	30267 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	2,500 cfs[b] 216,000 af[c]	
	Appropriative	Storage	30267 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	110,000 af	Petition to add on-island points of diversion for storage pending
Holland Tract	Appropriative	Direct diversion	2951 1922 priority	1415	1571	I	I	March 1- November 1	49.25 cfs	Primary right
	Riparian	Direct diversion	N/A	N/A	N/A	Ag	Ag/FWPE	N/A	Undefined	Secondary right
	Appropriative	Storage	29063 1987 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	December 15- May 1	69,050 af	
	Appropriative	Direct diversion	30269 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	2,500 cfs[b] 160,000 af[c]	
	Appropriative	Storage	30269 1993 priority	Pending	N/A	N/A	I/D/M&I/ FWPE/WQ	January 1- December 31	90,000 af	Petition to add on-island points of diversion for storage pending

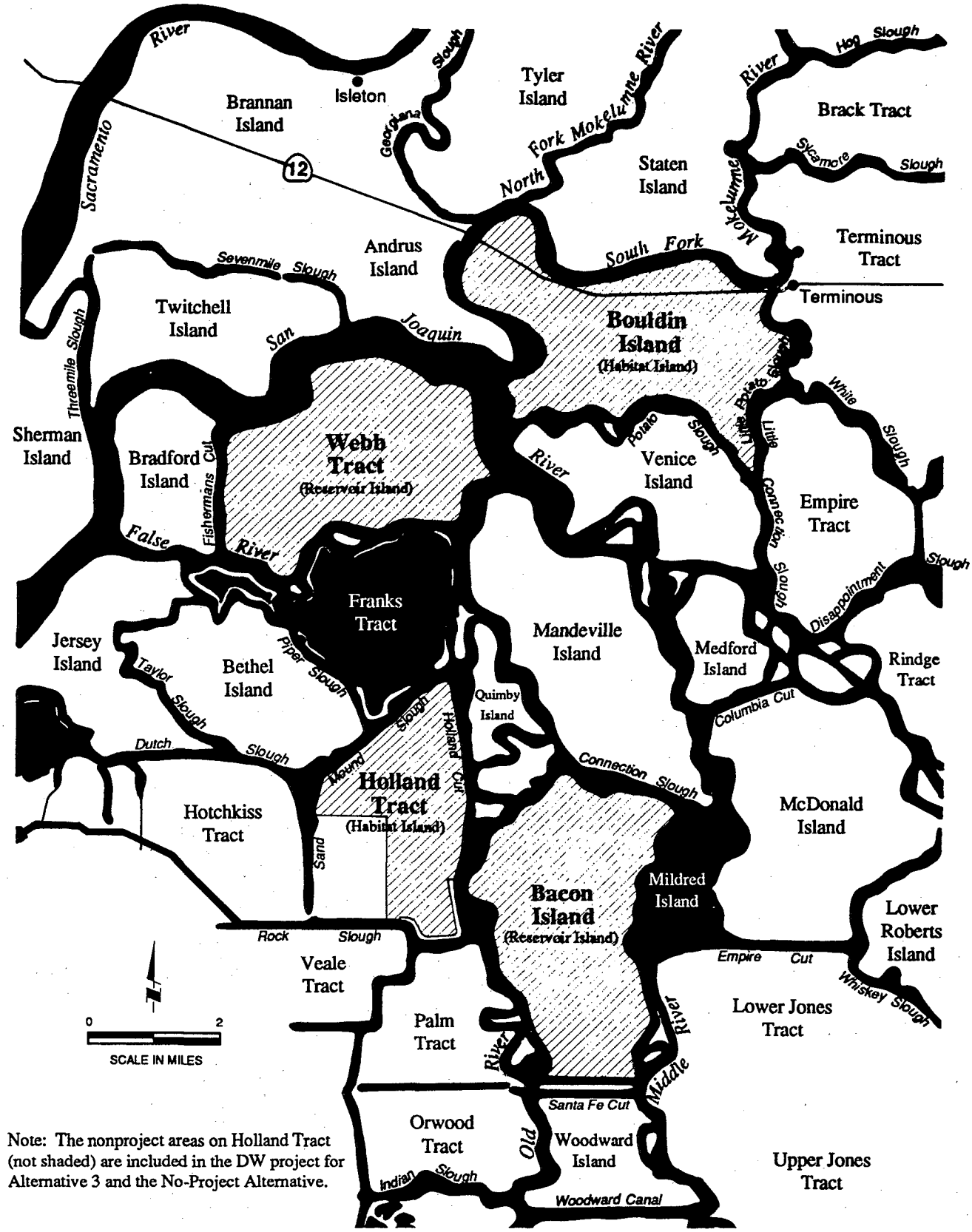
Notes:
Ag = agricultural.
D = domestic.
I = irrigation.
M&I = municipal and industrial.
FWPE = fish and wildlife preservation and enhancement.
WQ = water quality.
af = acre-feet.
cfs = cubic feet per second.

a The maximum potential annual diversion for each island is the sum of the 1987 priority and the 1993 priority (see Appendix 1, "SWRCB Public Notice for the Delta Wetlands Water Right Applications"); the actual diversions for the project would likely be substantially less than the maximum amount.

b 30-day average rate of diversion.

c Annual maximum amount.

N/A = not applicable.



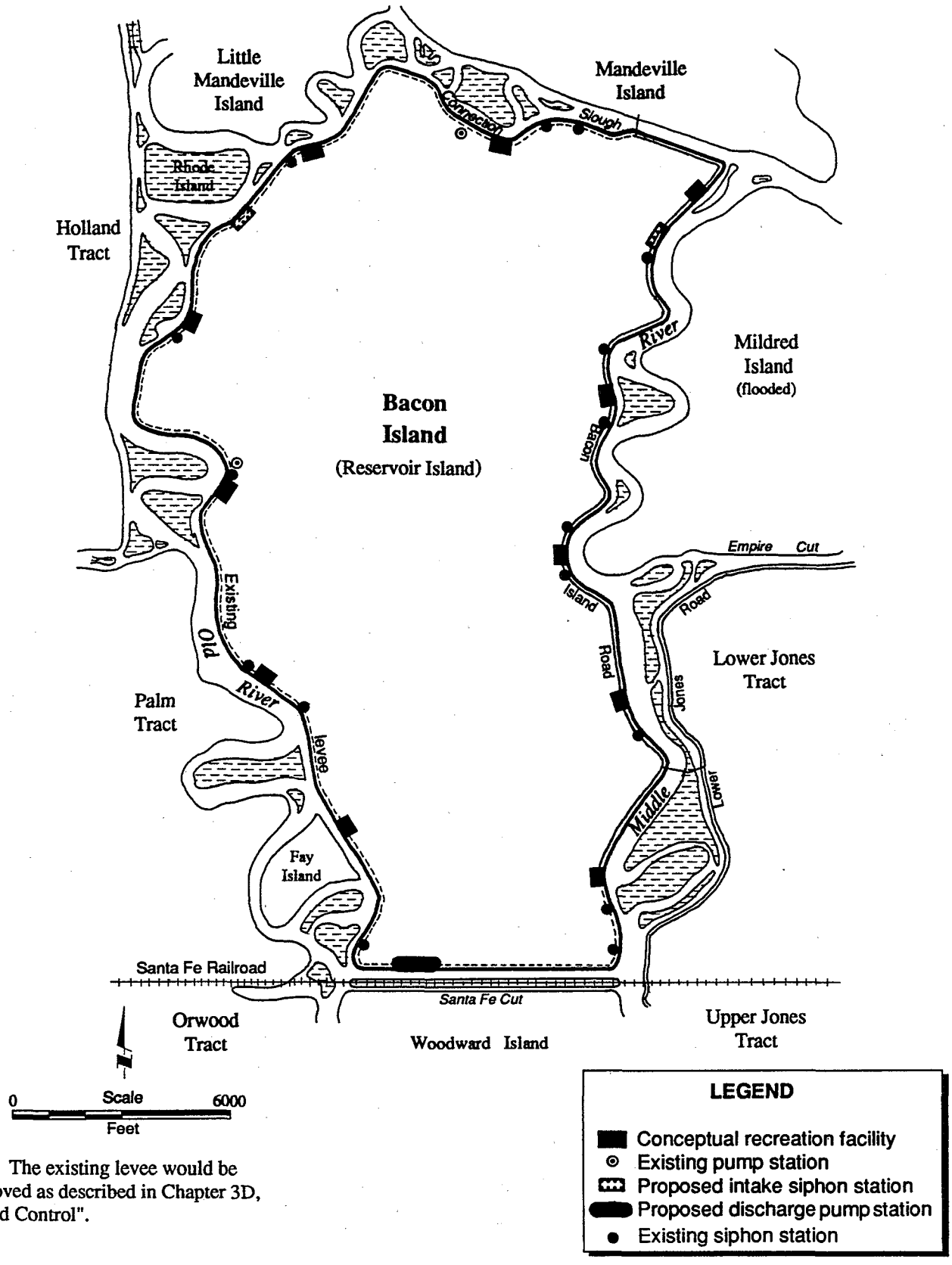
Source: Adapted from California Department of Water Resources 1993.

Figure 2-1.
DW Project Islands

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060410

C-060410



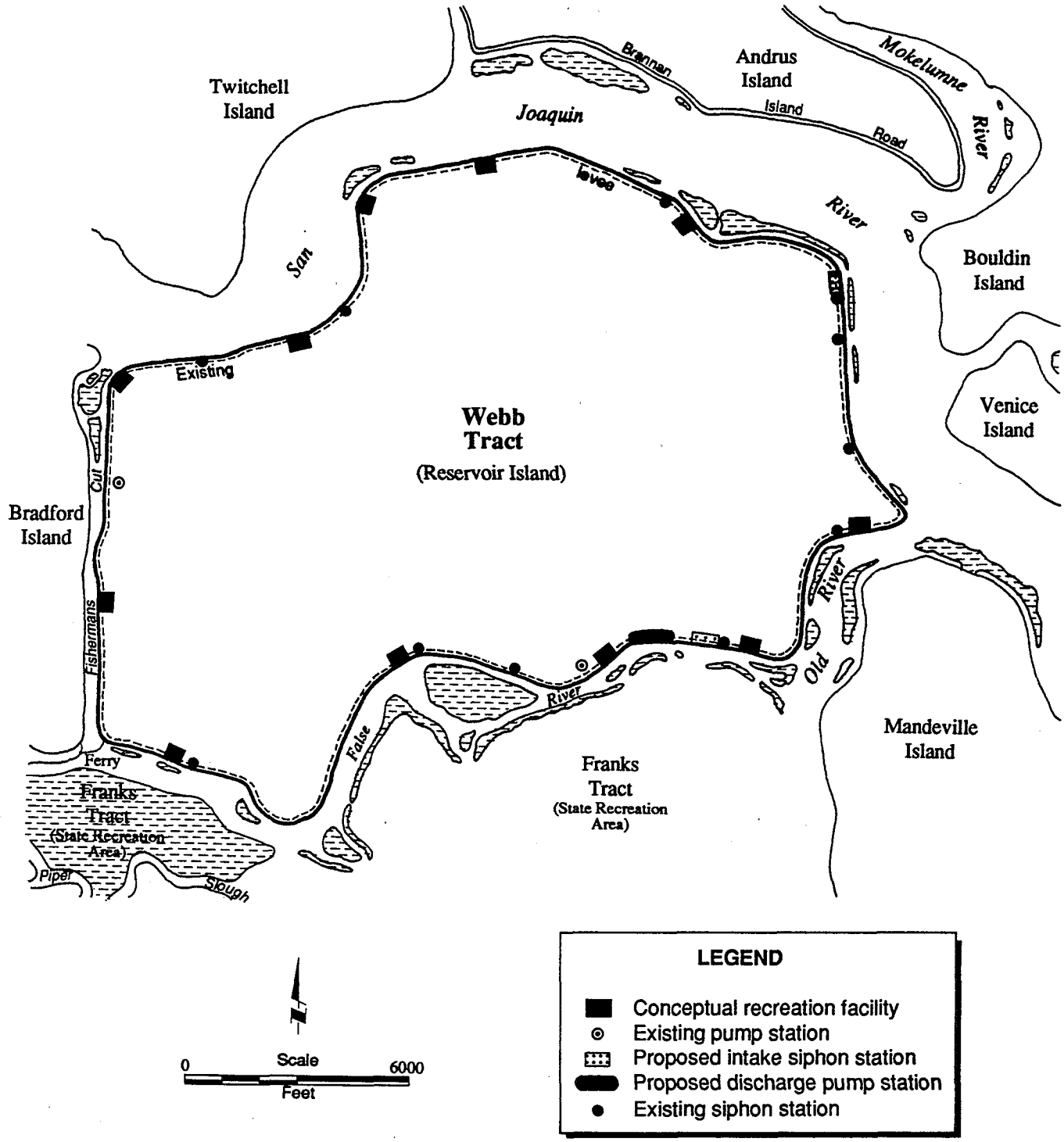
Note: The existing levee would be improved as described in Chapter 3D, "Flood Control".

Figure 2-2.
DW Project Facilities for Bacon Island under Alternatives 1, 2, and 3

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060411

C-060411



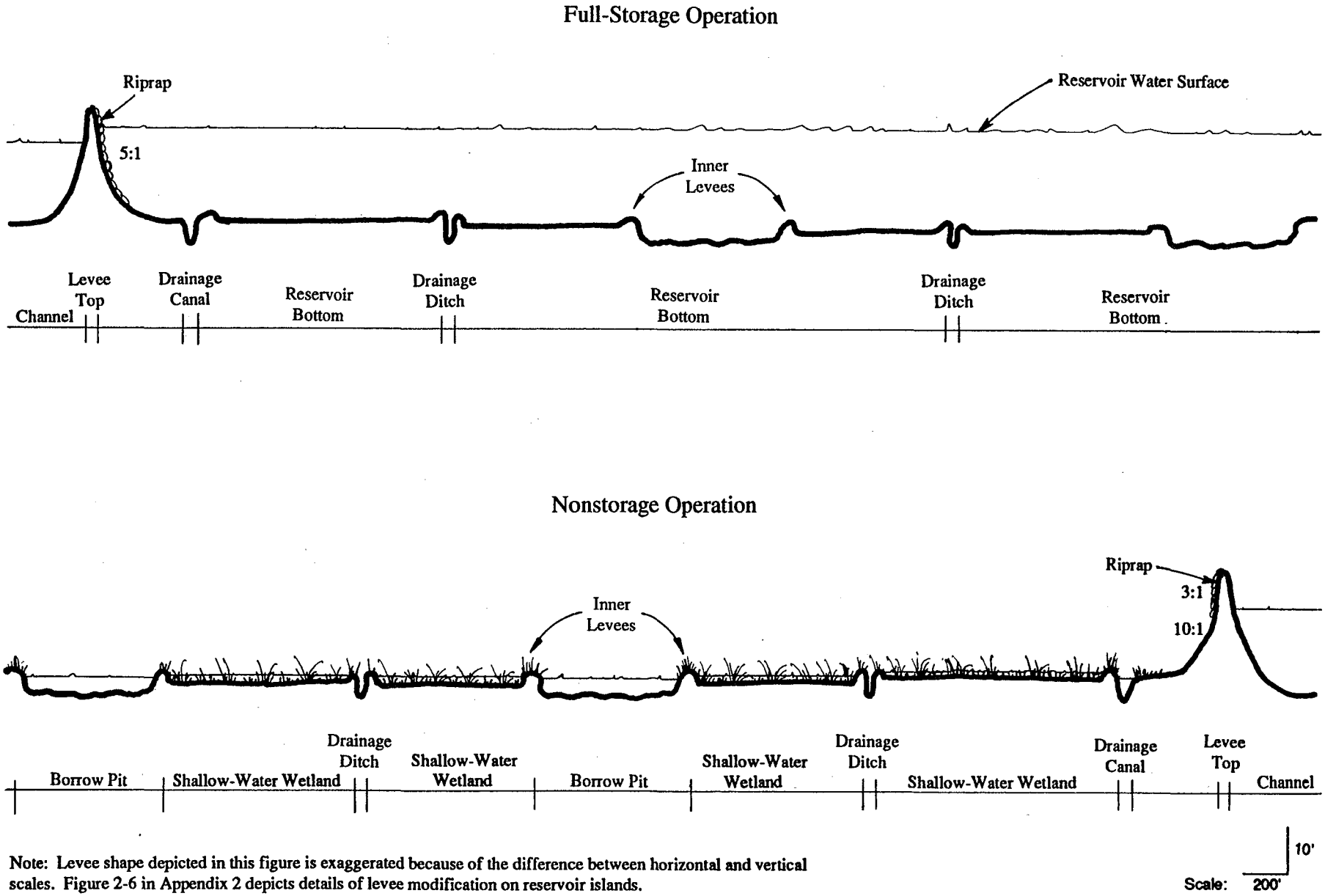
Note: The existing levee would be improved as described in Chapter 3D, "Flood Control".

Figure 2-3.
DW Project Facilities for Webb Tract under Alternatives 1, 2, and 3

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060412

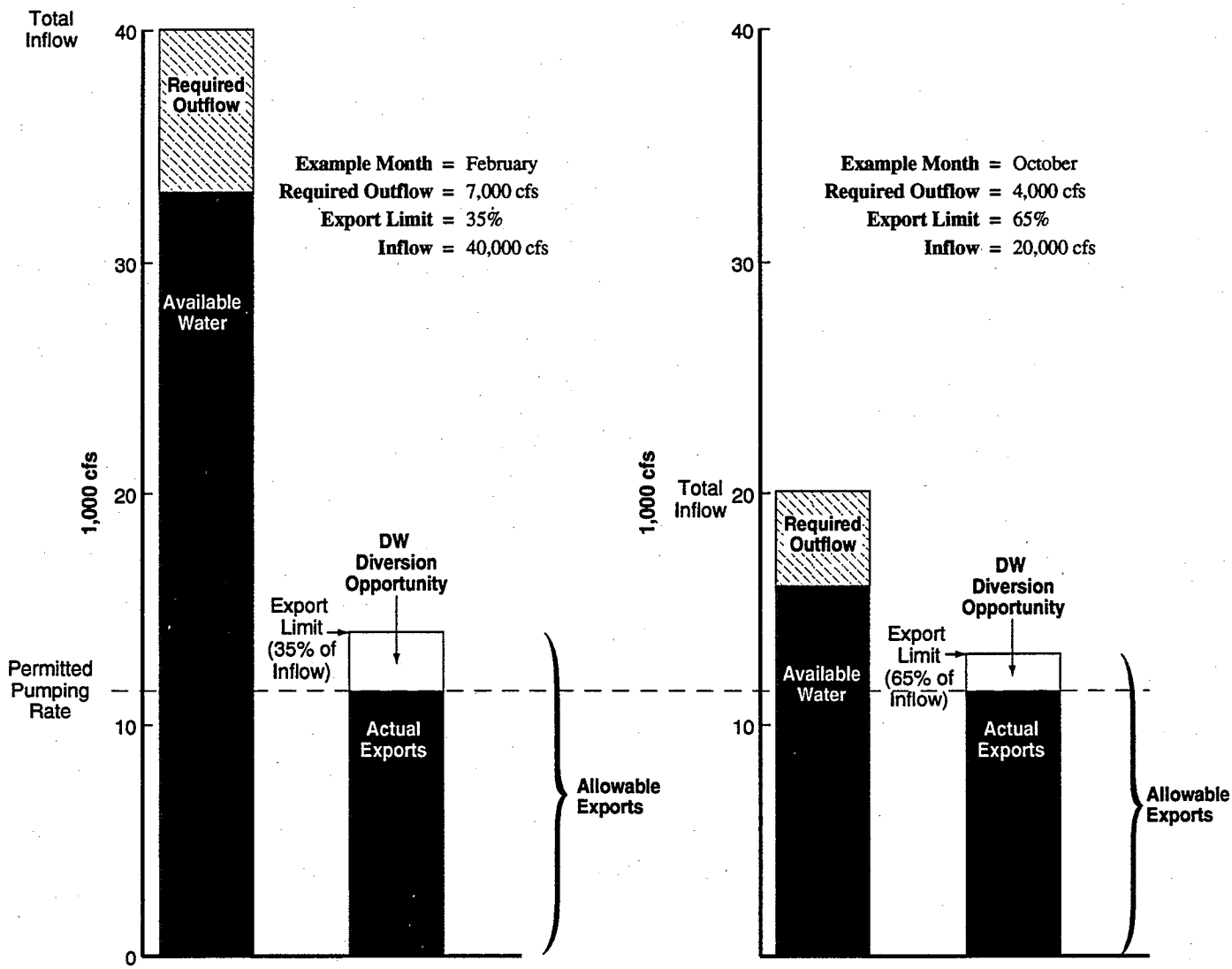
C-060412



Note: Levee shape depicted in this figure is exaggerated because of the difference between horizontal and vertical scales. Figure 2-6 in Appendix 2 depicts details of levee modification on reservoir islands.

Figure 2-4.
Conceptual Cross Section of Reservoir Islands

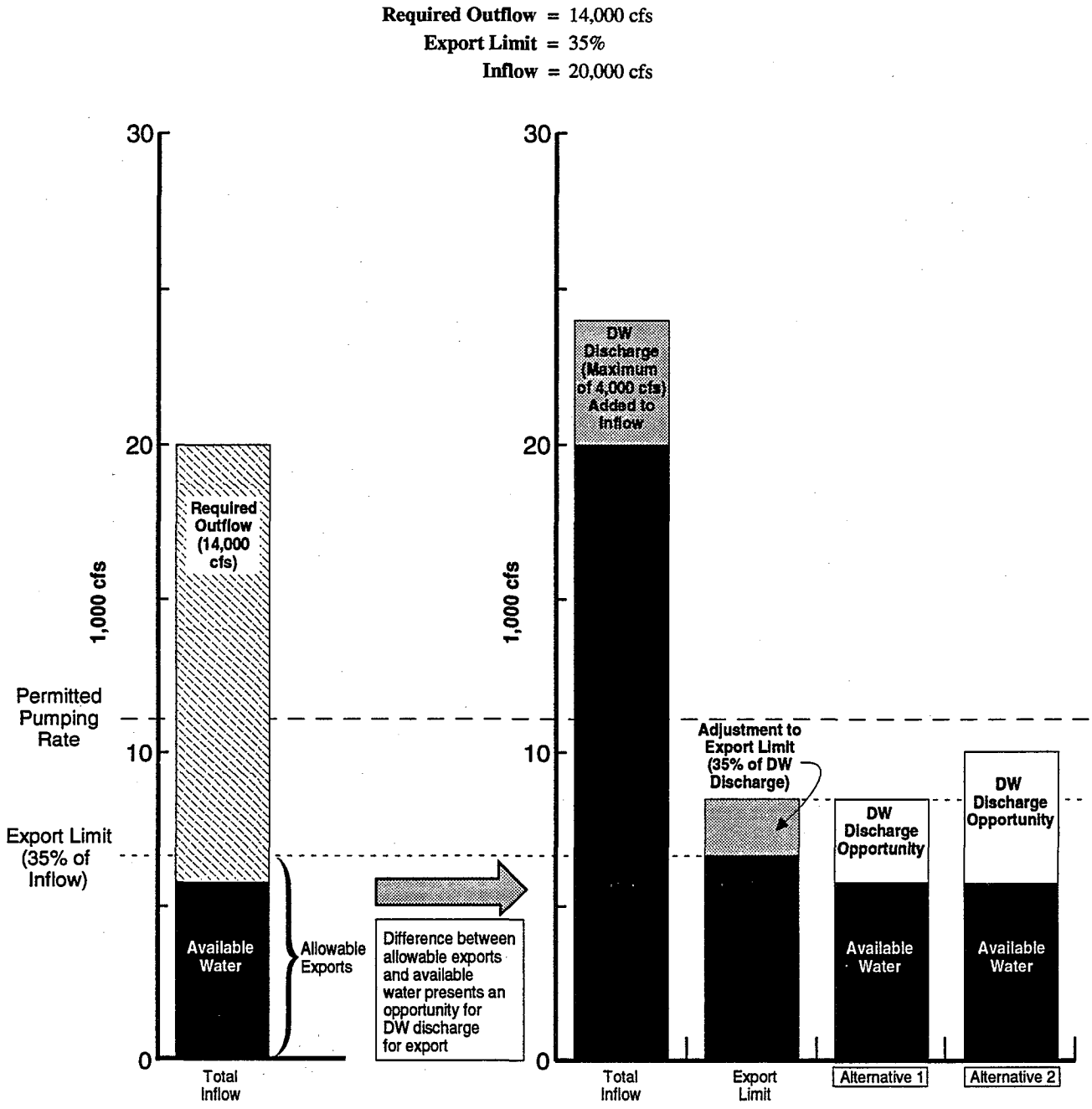
DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates



DW diversion opportunity = export limit - actual exports (actual exports limited by permitted pumping rate)

Figure 2-5.
Examples of DW Diversion Opportunities

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates



Alternative 1: DW discharge subject to the (adjusted) export limit

Alternative 2: DW discharge not subject to the export limit. The amount of DW discharge added to inflow and to the export limit are not relevant to this alternative. DW discharges for export would be allowed up to the permitted pumping rate as long as outflow requirements are met.

Figure 2-6.
Examples of DW Discharge Export Opportunities

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060415

C-060415

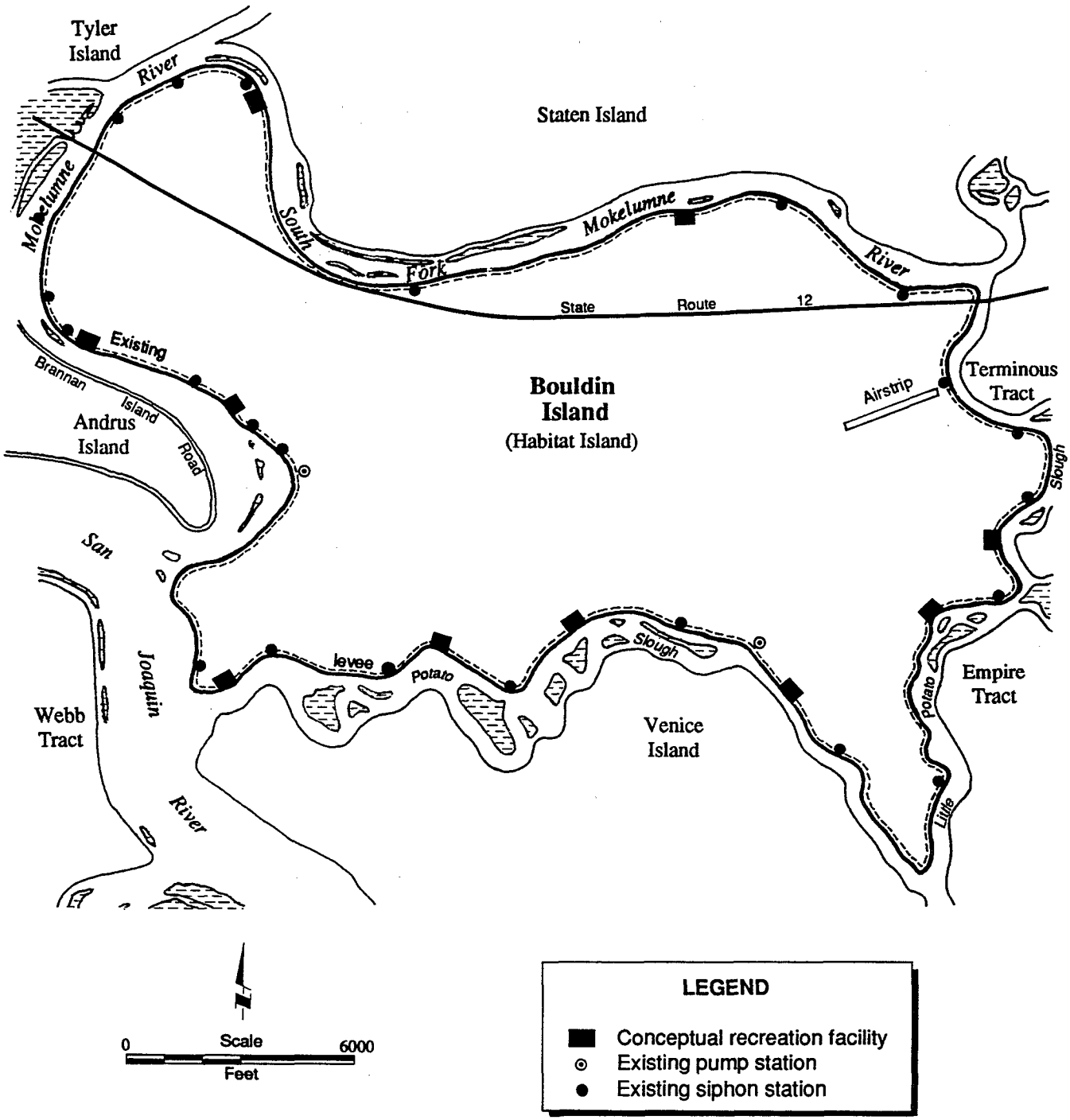


Figure 2-7.
DW Project Facilities for Bouldin Island under Alternatives 1 and 2

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060416

C-060416

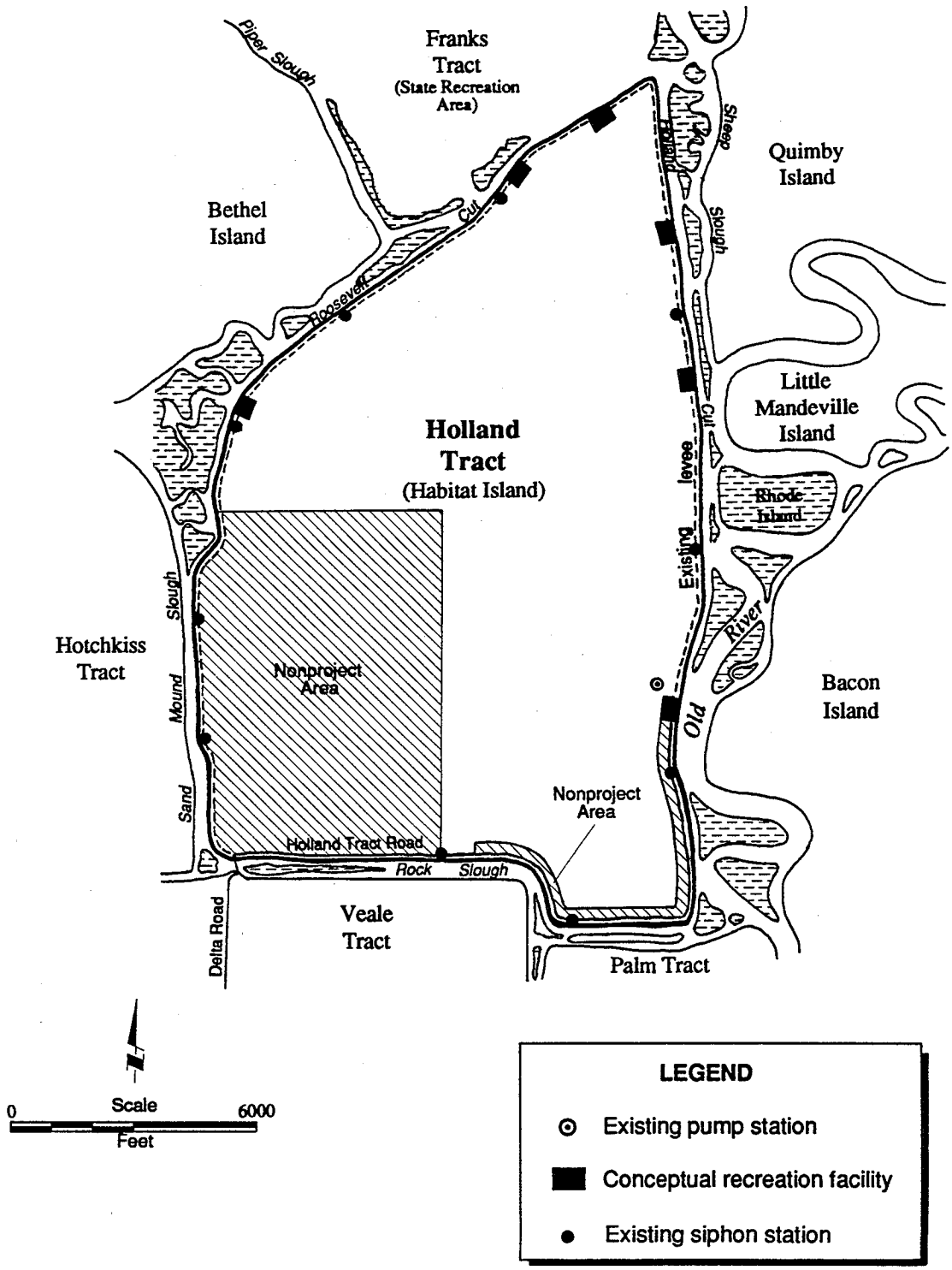


Figure 2-8.
DW Project Facilities for Holland Tract under Alternatives 1 and 2

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C-060417

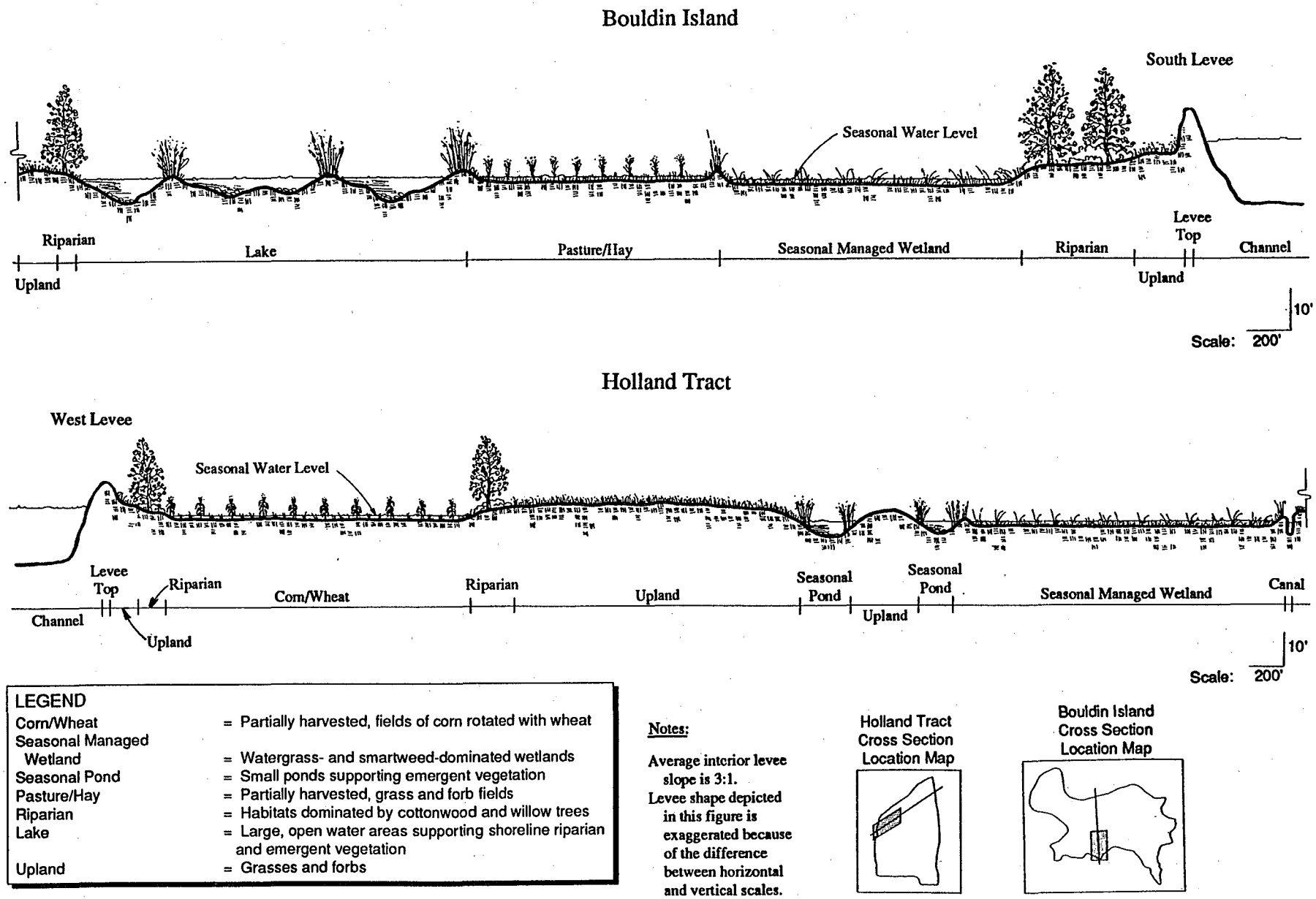
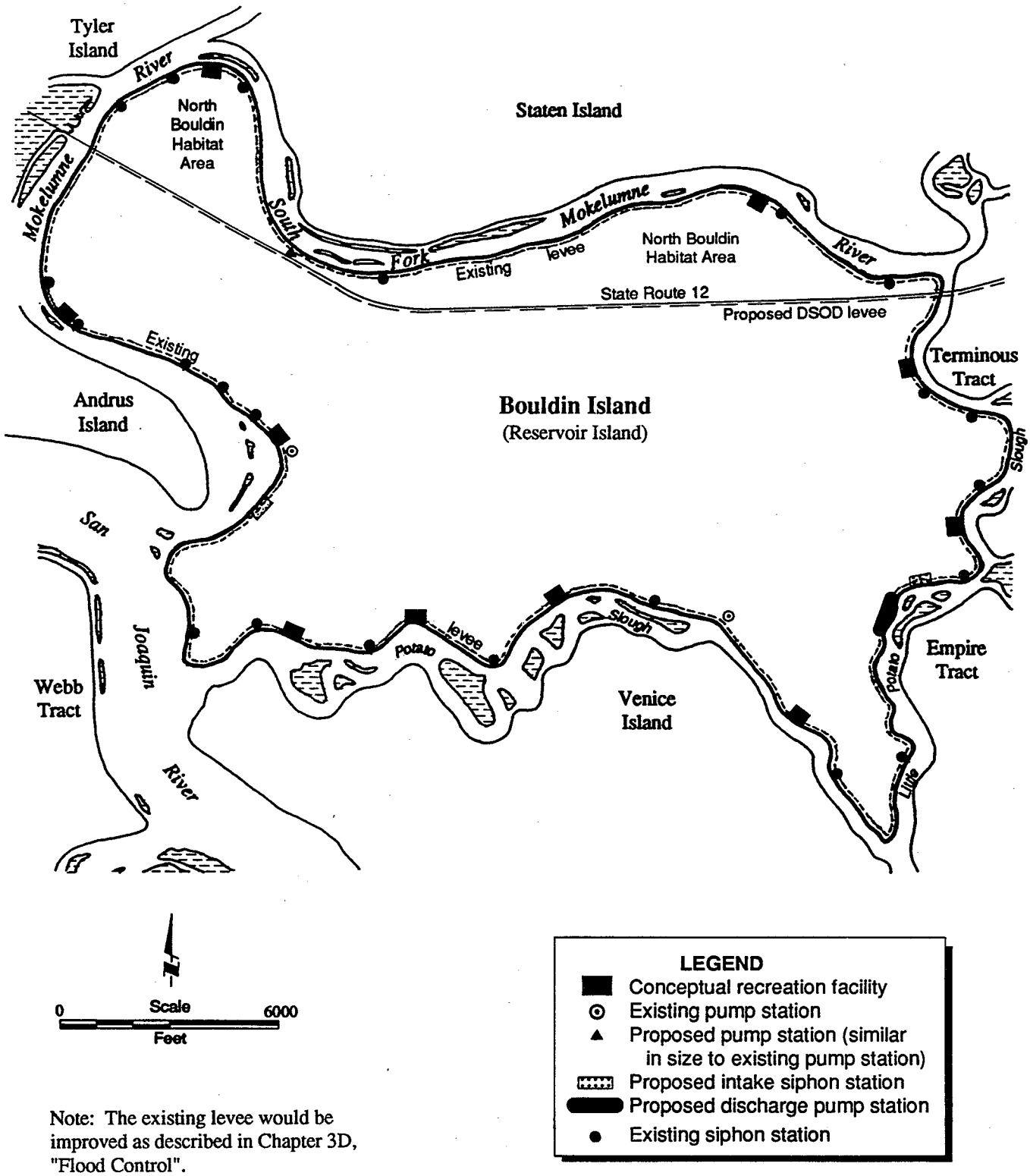


Figure 2-9.
Conceptual Cross Section of Habitat Islands under Fall Management Conditions

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C-060418



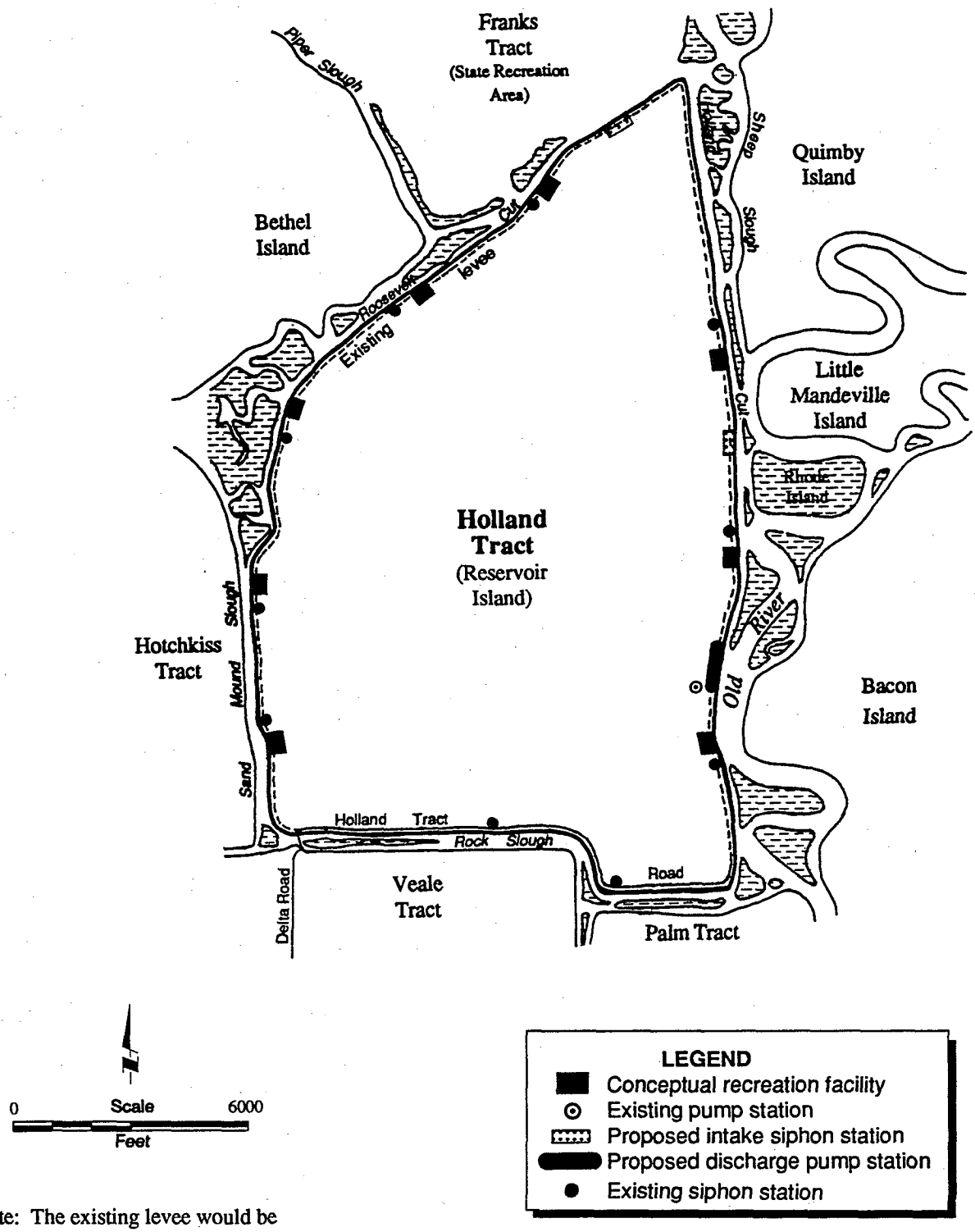
Note: The existing levee would be improved as described in Chapter 3D, "Flood Control".

Figure 2-10.
DW Project Facilities for Bouldin Island under Alternative 3

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060419

C-060419



Note: The existing levee would be improved as described in Chapter 3D, "Flood Control".

Figure 2-11.
DW Project Facilities for Holland Tract under Alternative 3

DELTA WETLANDS
PROJECT EIR/EIS
Prepared by: Jones & Stokes Associates

C—060420

C-060420