Chapter 3G. Affected Environment and Environmental Consequences - Vegetation and Wetlands

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SUMMARY

This chapter describes vegetation and wetland resources on the DW project islands and the impacts of the DW project alternatives on those resources. Impacts of the DW project include conversion of existing vegetation conditions (primarily agricultural) on the reservoir islands to open-water, mudflat, herbaceous, and shallow-water wetland habitats and conversion of existing vegetation conditions (primarily agricultural) on the habitat islands to crops and upland, wetland, woodland, and scrub habitats.

The impact analysis for the reservoir islands provides a description of vegetation and wetland values that would be associated with the various flood conditions on the reservoir islands; because future vegetation conditions are unpredictable, however, it is assumed that the reservoir islands would provide no wetland values that would compensate for project impacts.

Under Alternative 1, 2, or 3, construction of project facilities (e.g., siphon and pump stations or recreation facilities) and levee improvements on sites occupied by special-status plants could result in the loss of special-status plants; this would be considered a significant impact. Avoidance measures are recommended to reduce this impact to a less-than-significant level.

Implementing Alternative 1 or 2 would result in losses of riparian and permanent pond habitats and of upland and agricultural habitats. Losses in acreages of these jurisdictional wetland habitat types on the reservoir islands would be offset by creation of similar vegetation types on the habitat islands as described in the HMP; therefore, these losses are considered less than significant. Implementing the HMP under Alternative 1 or 2 would also result in a beneficial increase in freshwater marsh and exotic marsh habitats and the beneficial cumulative impact of an increase in wetland and riparian habitats in the Delta.

Under Alternative 3, the loss of jurisdictional wetlands on reservoir islands, including riparian, marsh, and pond habitats, would be considered a significant impact. Although a limited amount of habitat would be created in the NBHA to partially offset this impact, DW would need to develop and implement an offsite mitigation plan to reduce this impact to a less-than-significant level.

Under the No-Project Alternative, impacts would result primarily from conversion of fallow, herbaceous upland, riparian, and wetland habitats to agricultural use. In contrast to implementing any of the DW project alternatives, implementing the No-Project Alternative would decrease the diversity of vegetation types on the four DW islands. Implementing the No-Project Alternative would not result in direct disturbance of special-status plants from construction of facilities as described for the DW project alternatives. However, as increasing land subsidence rates and flood risks become critical to levee stability over time, improvements to perimeter levees under the No-Project Alternative could adversely affect known populations of plants.

CHANGES MADE TO THIS CHAPTER FOR THE FINAL ENVIRONMENTAL IMPACT STATEMENT

No substantive changes have been made to this chapter since the 1995 DEIR/EIS was published. In response comments on the 1995 DEIR/EIS, Mitigation Measure G-2, "Protect Special-Status Plant Populations from Construction and Recreational Activities", has been further defined to include monitoring requirements and performance standards. This minor modification does not change the conclusions of the analysis of project impacts on vegetation and wetlands presented below.

INTRODUCTION

This chapter discusses impacts of the DW project on vegetation and wetlands, most of which would result from water storage operations on the reservoir islands and from management of the habitat islands to provide project compensation. The HMP incorporated into the project description for Alternatives 1 and 2 provides for compensation habitat to be established on the habitat islands to offset the effects of reservoir island operations on vegetation and wetlands. The impact assessment for Alternatives 1 and 2 is therefore based on the assumption that project implementation would include the establishment of compensation habitat acreages as specified in the HMP. Under Alternative 3, all four DW project islands would be used as reservoirs, and the NBHA on Bouldin Island would be used to provide limited compensation habitat.

The following appendices provide more detailed information on vegetation and wetlands under existing conditions and predicted future conditions with project implementation on DW project islands:

- Appendix G1, "Plant Species Nomenclature";
- Appendix G2, "Prediction of Vegetation on the Delta Wetlands Reservoir Islands";
- Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands";
- Appendix G4, "Simulated End-of-Month Water Storage on Reservoir Islands for the Delta Wetlands Project Alternatives"; and
- Appendix G5, "Summary of Jurisdictional Wetland Impacts and Mitigation".

AFFECTED ENVIRONMENT

This section describes vegetation and wetland conditions on the DW project islands. Information on vegetation and wetlands is based in part on information collected for the 1990 draft EIR/EIS and has been updated to current conditions where these changes would affect the impact analysis.

As a result of land management decisions made since 1988, some changes in agricultural land use and vegetation conditions on the islands have occurred. Some of these changes were made in response to annual fluctuations in agricultural market conditions; others were made in anticipation of DW project implementation. Because some of these changes have resulted from project-related actions and influences, information from the 1990 draft EIR/EIS (based on 1988 conditions) provides the most reliable description of typical preproject vegetation and wetland conditions on the DW project islands for assessing the impacts of the DW project alternatives.

Sources of Information

Aerial photographs of the project area, taken in 1987, were used to identify and delineate vegetation types present on the DW project islands. Mappings of vegetation types were verified during surveys conducted in 1988. Classification schemes for habitat types were developed in consultation with DFG and USFWS.

Delineation of jurisdictional wetlands under Section 404 of the Clean Water Act was jointly conducted for the DW project islands by the Natural Resources Conservation Service (NRCS) (formerly the U.S. Soil Conservation Service), USACE, EPA, and USFWS in October 1994. In December 1994 and January 1995,

USACE and NRCS, respectively, verified delineations of waters of the U.S., including wetlands, on the DW project islands. Results of the delineation were used to identify the extent and types of jurisdictional wetlands on the DW project islands. Both verifications expired 5 years after they were issued. DW is currently working with USACE and Jones & Stokes to update the delineation to reflect current conditions on the project islands. Because farming conditions on the project islands have not substantially changed since 1994, the wetland conditions described in this chapter are sufficient for impact analysis purposes. However, USACE will verify an updated wetland delineation before it issues a decision on the project.

Special-status plant species that potentially could be found in the project area were identified in consultation with DFG and USFWS (see Appendix H5, "Agency Correspondence regarding the Federal and California Endangered Species Acts") and using California Native Plant Society (CNPS) lists (CNPS 1994), DFG's Natural Diversity Data Base (NDDB) (NDDB 1993), Smith and Berg (1988), and Madrone Associates (1980). Field surveys to locate special-status plant populations were conducted in spring and summer 1988. A portion of Webb Tract that could not be surveyed in 1988 was surveyed in August 1994.

Special-Status Plant Species

Definition of Special-Status Species

Special-status plant species are defined to include:

- species listed by the state of California as rare, threatened, or endangered;
- species that are federally listed, proposed for listing, or candidates for listing as threatened or endangered (55 FR 6184, February 21, 1990, and 50 CFR 17.12 [listed plants] and various notices in the Federal Register [proposed species]); and
- species listed by CNPS as rare and endangered (Smith and Berg 1988).

Special-status plant species potentially occurring in the project area were defined as those special-status species with known populations in or near the project area, and those known from habitats either identical to or similar to those found in the project area. The sources listed above under "Sources of Information" were used to develop a list of potentially occurring special-status plant species: DFG's NDDB (1993), Messersmith (pers. comm.) (included in Appendix H5, "Agency Correspondence regarding the Federal and California Endangered Species Acts"), Smith and Berg (1988), CNPS (1994), and Madrone Associates (1980). Based on this investigation, 14 special-status plants were identified as having the potential to occur in the project area (Table 3G-1), although none of these species were reported previously from the project area (NDDB 1987).

Consultations with DFG (Messersmith pers. comm.) identified seven other species not included in Table 3G-1 (Crampton's tuctoria, Bolander water hemlock, Contra Costa goldfields, Delta coyote thistle, caper-fruited tropidocarpum, Colusa grass, and palmate-bracted bird's beak). Potential habitat for these species does not exist in the project area.

Field Surveys

Field surveys for special-status plant species were conducted during April and August-September 1988. All potential habitat in the project area, including the water and land sides of exterior levees, was surveyed for the presence of special-status plants. The property on the eastern end of Webb Tract was not surveyed in 1988 because access was not available at the time of field surveys. This portion of Webb Tract, however, was surveyed in August 1994. Floristic field survey methods were employed as specified by DFG (1984).

Results of Surveys

Populations of the Suisun Marsh aster, Mason's lilaeopsis, rose-mallow, and Delta tule pea were detected during the field surveys; all were located on the water side of island levees (Dains 1988). These observations are summarized in Table 3G-2, and the locations of the populations of these species on the four DW project islands are shown in Figures 3G-1, 3G-2, 3G-3, and 3G-4. Population sizes at each location are described in Dains (1988). Populations of the Delta mudwort were detected along the exterior slopes of island levees. Population sizes and locations were not recorded during field surveys, however, because the Delta mudwort was not designated as a special-status species at the time surveys were conducted. No

unexpected special-status species were observed during the floristic surveys (Dains 1988).

No populations of the other species listed in Table 3G-1 were located. Although suitable habitat (i.e., sandy hummocks) for the Antioch Dunes evening primrose and Contra Costa wallflower appeared to exist in the project area, field surveys indicated that the sites were not suitable because they had previously been tilled.

Habitat Types

Classification Scheme and Mapping Methods

Nineteen habitat types in seven major habitat groups were designated in a classification scheme designed specifically for the DW project islands (Table 3G-3). The habitat-type classification scheme was developed in consultation with DFG and USFWS. The major habitat groups are riparian, marsh, woody non-native, herbaceous upland, agriculture, open water, and developed land. The five agricultural habitat types (grain and seed crops, perennial crops, livestock pasture, waterfowl food crops, and fallow fields) were subdivided by crop type where possible. Abandoned agricultural fields and other weedy sites are included in the marsh or herbaceous upland groups, depending on species composition and field moisture conditions.

Vegetation was mapped on the DW project islands using the habitat classification scheme shown in Table 3G-3 to describe the conditions on the islands as of December 1987. Habitat-type mapping was based on color aerial photographs of all four islands taken on October 5, 1987, at a scale of 1:24,000. Preliminary determinations of habitat types and boundaries were traced onto mylar overlays, based on inspection of the color prints that had been enlarged to a scale of 1:12,000 from the original negatives. Habitat types were mapped to a minimum polygon size of approximately 1 acre.

Habitat types were observed directly from low-altitude aircraft and during vehicle and foot surveys of all four islands during January-June 1988. The initial habitat-type delineations were corrected and refined through these observations.

Descriptions of Habitat Types

The portions of the four DW project islands included in Alternatives 1 and 2 encompass 20,128 acres (about 31 square miles) (Figures 3G-5 through 3G-8). This section describes habitat conditions and acreages that would be affected under implementation of Alternative 1 or 2. Alternative 3 and the No-Project Alternative would include use of the southwest quarter of Holland Tract, which is excluded under Alternatives 1 and 2 (Figure 3G-9).

Acreages of each of the seven habitat types and their subgroups for each alternative are shown in Table 3G-4. The acreage figures were produced by planimeter measurement of areas on the habitat-type maps of the four DW project islands completed in June 1988.

Agriculture. Approximately 63% of the DW project island acreage is in active agricultural use (types A1 and A2 in Table 3G-4). Much of the remaining agricultural land was in a temporary fallow condition (i.e., fallow for less than 2 years) (type A5) in December 1987 because of soil or pest management problems, agricultural "set-aside" programs, land ownership transfers, or farm bankruptcy. All developed land (types D1 and D2) is directly associated with agricultural operations, with the exception of two small commercial marinas on Holland Tract.

Much of the agricultural land remained disked or flooded during the onsite field mapping in spring 1988. A determination of crop types on these fields was made with maps and tables showing crop allocations acquired from farming companies. Farmers and landowners were also contacted to determine which crops were typically grown in each major field and why some fields remained fallow or were abandoned.

The predominant field crops in type A1 are corn, wheat, milo, sunflower, and potato. About 8.8% of the agricultural land is in perennial crops (type A2), such as asparagus (1,492 acres) or vineyards (278 acres). Only 445 acres are permanently managed as pasture and are grazed, primarily by beef cattle (type A3). A much larger area of field crops (type A1), probably several thousand acres, is grazed seasonally by sheep for weed control and stubble reduction.

On Holland Tract, DW's demonstration wetland for testing of watergrass seed production was mapped separately as type A4. During 1988 and 1989, water

levels were managed in this wetland to simulate the hydrologic regime of the DW project as proposed at that time.

Management of agricultural lands on the DW project islands must address problems endemic to Delta lands, including poor irrigation drainage, disease outbreaks, declining soil productivity, and weed infestation. The primary method of watering crops on the four islands is to apply water through siphon pipes from sloughs or channels to a network of canals and ditches on each island. Higher elevation fields that are better drained are irrigated with traditional surface irrigation techniques.

The shallow water table, in combination with the organic peat soil, creates a soil condition favorable to the outbreak of plant pathogens and destructive nematodes. Therefore, crop options are limited to shallow-rooted species and varieties that are resistant to diseases, including most grain crops in the grass family. Orchards and most vegetable crops are conspicuously absent. Long-term productivity also is declining as a result of the oxidation of peat soils exposed during cultivation.

Another chronic management problem on Delta islands is field infestation by weeds, especially Johnson grass, canarygrass, smartweed, land kelp, peppergrass, cocklebur, and other moisture-dependent exotic weeds. Drainage and irrigation ditches must also be cleared annually of woody invaders, primarily exotic Himalaya berry, willow, and cottonwood. The extensive network of ditches in the fields is an ever-present transport system for waterborne weed seed (both woody and herbaceous).

Riparian Habitat. Riparian habitat is associated with areas at the margins of perennial and intermittent streams, rivers, and other water bodies that have abundant soil moisture. Two woody riparian habitat types are found on the DW project islands: cottonwood-willow woodland (type R1) and willow scrub (type R2). Type R2 is generally less than 5 years old and consists of four species of willows mixed with cottonwood seedlings. Type R1 is generally older than 5 years and contains cottonwood saplings and trees taller than the willow shrub understory.

Because weeds become established readily on Delta islands, farm management emphasizes "clean farming" practices that include annual disking of fallow fields and periodic clearing of riparian trees and shrubs from the interior ditch systems. Only about 1% of the DW project islands is occupied by woody riparian habitat (types R1 and R2) (Table 3G-4). Most of this habitat type is found on Webb and Holland Tracts, where agricultural management is less intensive and has not kept pace with natural colonization by water-dependent weeds and woody riparian plants.

Most riparian vegetation on the DW project islands is in an early stage of development. Small linear stands of willow and cottonwood are often found in or along ditches or at the toes of perimeter levees that have not been regularly maintained. Maintenance policies of the local reclamation districts do not allow mature woody vegetation on the upper interior levee slopes or on exterior levee faces because of the need to inspect the levees for seepage and structural defects.

The exceptions to the above pattern are the somewhat older and more diverse stands of riparian and marsh vegetation surrounding the blowout ponds on Webb and Holland Tracts. These small lakes (type O2) were scoured into the island bottoms by suddenly inrushing flood waters from exterior channels, typically 15-20 feet higher than the interior island elevations, following levee failures in 1950 on Webb Tract and in 1980 on both islands. The blowout ponds are generally not economically feasible to reclaim as agricultural land. Saturated soils on the pond perimeters prevent mechanical clearing of vegetation.

Riparian vegetation began to become established around the Holland Tract blowout pond in summer 1980 after floodwaters had been pumped from the island. Floodwaters were not pumped from Webb Tract until February 1981 (Kjeldsen pers. comm.). Thus, most riparian vegetation is 15 years old on Holland Tract and 14 years old on Webb Tract.

Marsh. Marsh habitat is dominated by herbaceous plant species growing in soil inundated by water for long periods, if not indefinitely. Tidal marsh (type M2) exists only along the outside margins of the DW project islands. Nontidal freshwater marsh (type M1) occupies 224 acres on the four islands, 77% of which was found on Webb Tract primarily around the two blowout ponds (Table 3G-4). This habitat type is typically associated with riparian and open-water habitats in relatively undisturbed locations. Dominant plants include cattail, tule, bulrush, other emergent wetland species, and button bush.

Exotic marsh vegetation (type M3) occupies 5.6% (1,124 acres) of the DW project islands, primarily on Webb and Holland Tracts (Table 3G-4). In December 1987, this type consisted of former agricultural fields, which, for various reasons, were abandoned or left fallow for more than 2 years and subsequently had been invaded by dense stands of exotic herbaceous weeds. Typical weedy species include nettle, annual smartweeds, peppergrass, field mustard, wild radish, dallisgrass, curly dock, amaranth, and watergrass. The depth to the water table determines whether these abandoned fields are invaded by exotic marsh weeds or herbaceous upland weeds. This type sometimes occupies small untilled sites in actively farmed fields.

Herbaceous Upland. Annual grassland (type H1), found primarily on the broad, gentle interior slopes of the perimeter levees, occupies 7.5% of the project islands (about 1,514 acres). Typical annual grassland species include canarygrass, ripgut brome, mustard, and bur-clover. Levees may be grazed but are not cultivated. A portion of this type is upland habitat on remnant knolls or sand hills on Webb and Holland Tracts. If the sand hills were actively cultivated for dry-farmed grain in December 1987, they are included in agricultural type A1.

Exotic perennial grassland (type H2) is a habitat type with moisture conditions ranging between those of annual grassland (type H1) and exotic marsh (type M3). Soil moisture is adequate year round to support lush growths of perennial grasses (e.g., Bermuda grass, perennial ryegrass, saltgrass, and Johnson grass) and annuals but is not wet enough in the dry season to support typical wetland species (e.g., cattails, rushes, dock, tules, and bulrushes). More mesic (moderately moist) portions of the interior levee slopes may include this habitat type.

Both exotic marsh (type M3) and exotic perennial grassland (type H2) tend to be ruderal plant communities that colonize previously disturbed sites, such as abandoned fields, mowed levees, or flooded corners of active crop lands. If not disturbed for several years, they tend to be replaced by native woody riparian or freshwater marsh species. The abandoned agricultural fields near the blowout ponds on Holland and Webb Tracts demonstrate this natural gradient of vegetation development.

Open Water. Open water covers 2.2% (433 acres) of the land surface on the four DW project islands. Three-fourths of this area consist of canals and major drainage ditches (type O1) with permanent water in the island interiors. These ditches are typically lined with narrow bands of exotic marsh vegetation or Himalaya berry. Plants adapted to drier soil conditions, such as yellow star-thistle, are found along upper ditch slopes and on ditch spoils piles. Overhanging riparian vegetation is rare along the ditches or canals. The 124 acres of permanently ponded water (type O2), consisting primarily of the three blowout ponds on Holland and Webb Tracts, are lined with dense riparian or emergent wetland vegetation. Tidal mudflats (type O3) exist only on the outside margins of Bacon and Bouldin Islands along tidal channels.

Developed Land and Woody Non-Native Vegetation. Approximately 1% of the land area of the DW project islands is occupied by structures, paved roads, or scarified and compacted soil (types D1 and D2). This land type includes all of the levee crown roads and agricultural staging areas. The largest portion of type D2 is a site for processing and storing a pulp by-product used as a soil amendment on Holland Tract. Woody, non-native vegetation consists of ornamental trees (type W1) and shrubs and lawns (type W2) generally associated with structures (type D1).

Habitat Types on the DW Project Islands

Bacon Island

Bacon Island was occupied by five major landowners and farming operations in December 1987. All tillable land on Bacon Island in December 1987 was in production, the island infrastructure was in good repair, and stands of native vegetation were virtually absent (Figure 3G-5). Agricultural crops were diverse and included corn, milo, potato, sunflower, asparagus, grape, kiwi, and potato seed. The dominant annual crops were potato (1,883 acres) and corn (776 acres). No significant bodies of open water were present, except for the major north-south drainage slough.

Webb Tract

Major portions of Webb Tract were under intensive agricultural management, primarily for corn (2,223 acres) and wheat (445 acres), in December 1987. Like Holland Tract, Webb Tract has a mosaic of sand hills

and upland habitat in the western half. Elevation varies by 20 feet or less between hilltops and fields.

Two blowout ponds on Webb Tract make up 85% (106 acres) of the perennial ponded water on all four DW project islands (Figure 3G-6). The northernmost lake formed during a levee breach in 1950 and the eastern lake formed following a levee breach in February 1980. Both levee failures resulted in prolonged deep flooding of the island; the 1980 flooding lasted from January 1980 until February 1981. The lakes are surrounded by richly diverse riparian vegetation and have no public access. Fallow fields and extensive stands of riparian vegetation are common on Webb Tract, particularly on the northern and southwestern portions of the island.

Bouldin Island

Bouldin Island Farming Company manages this entire island intensively as an integrated agricultural operation, with corn production representing more than half of the cultivated acreage (Figure 3G-7). Bouldin Island is a good example of clean farming practice; the levees and roads are well maintained, as are the agricultural fields and ditches. Natural or native vegetation is virtually absent, and most of the tillable land is in crops; 712 acres are under the Agricultural Stabilization and Conservation Service set-aside program. Three crops, corn, sunflower, and wheat, accounted for all agricultural production in December 1987.

Holland Tract

Agricultural management on Holland Tract was less intensive than on Bacon and Bouldin Islands in December 1987 and represented only about one-third of all land cover (Figure 3G-8). Holland Tract has natural sand hills and a blowout pond in the northern tip (17 acres) formed during a levee breach in 1980.

Several land use types are unique to Holland Tract among the four DW project islands. Two commercial marinas occupy the southside levee. A hunting club leases a large portion of the southwestern corner. A large, year-round livestock grazing operation with irrigated pasture was located in the southwestern corner of Holland Tract in December 1987. Because of farm bankruptcy and land ownership changes, much of the agricultural land in the southeastern corner of Holland Tract had not been actively managed for several years.

Under Alternative 3 and the No-Project Alternative, approximately 1,113 acres in the southwest quarter and southeast perimeter of the island would be included in the project (Table 3G-4, Figure 3G-9).

Section 404 Jurisdictional Wetlands

Approximately 763 acres of riparian woodland, riparian scrub, freshwater marsh, exotic marsh, canal and ditch, permanent pond, herbaceous upland, and seed and grain crop habitats were delineated by NRCS, USACE, EPA, and USFWS as jurisdictional wetlands under Section 404 of the Clean Water Act. A detailed description of the results of the jurisdictional wetland delineation is presented in Appendix G5, "Summary of Jurisdictional Wetland Impacts and Mitigation".

As described above, Delta Wetlands is currently working with USACE and Jones & Stokes to update the delineation to reflect current conditions on the project islands. The updated delineation will identify waters of the U.S., including wetlands, on the project islands and in channels where project facilities (e.g., pump and siphon stations) would be located. Before issuing a permit under the CWA and Rivers and Harbors Act, USACE will revise the estimates of wetland impacts based on more detailed investigations. Because farming conditions on the project islands have not substantially changed since 1994, the estimated acreage of wetland impacts presented in Appendix G5 is not expected to change significantly.

Regional Values and Distribution of Habitat Types

Madrone Associates (1980) described riparian woodland as the most valuable wildlife habitat in the Delta, providing essential habitat for 34 species of birds and one mammal. Over 100 wildlife species were found to use this habitat type regularly. Riparian woodlands provide wildlife values that can extend roughly 0.25 mile into adjacent habitat, such as agricultural fields or seasonal wetlands. Freshwater perennial marshes were ranked as the second most valuable wildlife habitat in the Delta by Madrone

Associates (1980), supporting 57 different wildlife species.

Madrone Associates (1980) mapped habitat types found on nearly 600,000 acres on Delta islands, such as the four DW project islands; these were distributed as follows:

Habitat Type	Area (acres)	Percentage of Total
Perennial emergent wetland (freshwater and brackish)	10,243	2
Riparian woodland and scrub	7,099	1
Freshwater lakes, ponds, and interior sloughs	6,913	1
Upland	44,446	7
Agriculture	531,156	89
Total	599,857	100

This distribution demonstrates the regional scarcity of riparian woodland and perennial freshwater marsh habitats in the Delta region relative to agricultural lands.

IMPACT ASSESSMENT METHODOLOGY

Analytical Approach and Impact Mechanisms

Impacts on vegetation on the DW project islands were evaluated through comparison of predictions of future habitat types and acreages under the DW project alternatives with existing vegetation conditions. Changes in vegetation types would result from the construction of facilities, upgrading of levees, inundation of reservoir islands during water storage and seasonal wetland periods, and implementation of the HMP (see Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands").

Alternatives 1, 2, and 3

A detailed description of the approach used to analyze future vegetation conditions on reservoir islands is presented in Appendix G2, "Prediction of Vegetation on the Delta Wetlands Reservoir Islands".

Assessment of future vegetation conditions on reservoir islands is difficult because periods of inundation and drawdown are not predictable between years and the annual hydrologic pattern of the project does not naturally occur in the Delta region. Prediction of future vegetation conditions is based on end-of-month water storage amounts predicted by the DeltaSOS simulations conducted for the 1995 DEIR/EIS. Additional simulations were performed for the updated evaluation of project operations under the proposed project in the 2000 REIR/EIS, as described in Chapter 3A, "Water Supply and Water Project Operations"; however, the differences in DeltaSOS results in the 1995 DEIR/EIS and 2000 REIR/EIS evaluations of Alternatives 1 and 2 do not affect the conclusions of this chapter. Therefore, the analysis of reservoir island vegetation conditions from the 1995 DEIR/EIS remains unchanged and is presented below. The 1995 DeltaSOS simulations estimated amounts of water that would be available to the project under each of the DW project alternatives in years with hydrologic conditions replicating those of the 70-year 1922-1991 Delta hydrologic record (Appendix G4, "Simulated End-of-Month Water Storage on Reservoir Islands for the Delta Wetlands Project Alternatives"). The availability of future water for storage, however, may not follow historical availability. Prediction of future conditions on any island is further complicated because DW may also fill reservoir islands in a sequence that changes each year to maximize the potential for creating wetland habitats. DW may also use reservoir islands to bank or store water being transferred through the Delta by other entities. For this analysis, it was assumed that reservoir islands would fill concurrently as water becomes available for storage. Under this operating scenario, vegetation would be inundated simultaneously on both reservoir islands under Alternative 1 or 2 or on all four islands under Alternative 3. This concurrent filling would have more adverse effects on terrestrial vegetation than sequential filling would have.

Because future habitat conditions are unpredictable and cannot be quantified, reservoir islands were assumed in this impact assessment to provide no vegetation or wetland values that would offset project

impacts. Therefore, operation of the reservoir islands to support habitat conditions is not required to offset or compensate for impacts of the project on vegetation or wetland values.

Analysis of future vegetation conditions on the habitat islands under Alternatives 1 and 2 is based on habitat types and acreages described in the HMP (see Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands").

USACE has not determined whether wetlands created by operation of reservoir islands or established on habitat islands (except those dedicated as mitigation for jurisdictional wetlands) would be jurisdictional or nonjurisdictional under Section 404 of the Clean Water Act. However, USACE will make this determination in consultation with DW before the project is implemented.

No-Project Alternative

Estimates of island conditions under the No-Project Alternative are based on a feasibility study prepared for DW by the McCarty Company, Diversified Agricultural Services (McCarty pers. comm.). The general recommendation for all islands is to increase cultivated acreage and crop diversification, with a greater emphasis on perennial crops such as asparagus and vineyards.

Criteria for Determining Impact Significance

SWRCB and USACE determined that for this analysis, an alternative would be considered to have a significant impact on vegetation if it would reduce jurisdictional wetland acreage or habitat value over the life of the project or reduce the size or extent of special-status plant populations.

Beneficial impacts would be increases in the quality or extent of riparian or wetland habitats.

IMPACTS AND MITIGATION MEASURES OF ALTERNATIVE 1

Vegetation Conditions

Bacon Island and Webb Tract

Island Interiors. Five types of habitat conditions are predicted to occur on the reservoir islands under the DW project alternatives: full storage, partial storage, shallow storage, nonstorage, and shallow-water wetlands (see Appendix G2, "Prediction of Vegetation on the Delta Wetlands Reservoir Islands"). The definitions of these habitat conditions are applicable only to the analysis of project impacts on vegetation resources and wildlife.

For this analysis, it was assumed that during periods when water was available for storage, water would be simultaneously diverted onto Bacon Island and Webb Tract as a "worst-case" operating scenario. This operating scenario would have the greatest impact on vegetation and wetlands. However, DW may sequentially fill the reservoir islands. If reservoir islands were sequentially filled, impacts would be lessened.

The frequency of full-, partial-, and shallow-storage periods would increase and the frequency of nonstorage and shallow-water wetland periods would decrease, however, if the DW reservoir islands were used for storage of water for transfer or for water banking (see Chapter 2, "Delta Wetlands Project Alternatives"). Although the frequency and magnitude of such activities is uncertain at this time and these activities would require separate authorization, implementation of the HMP would fully compensate for any vegetation impacts associated with operation of the DW project for water transfer or banking. Impacts on other resources may require analysis in a future CEQA/NEPA process.

Tables G2-1 and G2-2 in Appendix G2 present the monthly frequency with which each of the five conditions described below would be expected to occur on the reservoir islands.

Full Storage. Under full-storage conditions, all portions of the reservoir islands except riprapped levee slopes would be completely inundated. Conditions on islands during full-storage periods would include ex-

posed riprapped levee slopes at elevations higher than the reservoir surfaces and reservoir water depths in excess of 25 feet over the lowest island bottom areas. Little or no aquatic vegetation would be expected to grow in the reservoirs because of constant water circulation and changing pool elevations associated with diversions and releases. Algae may become established on riprap along reservoir edges and in reservoirs during the warm season.

Partial Storage. Partial-storage conditions would provide shallow to deep water storage pools, exposed island bottoms, and riprapped levee slopes above the storage elevation. Reservoir island habitat conditions will vary more under partial-storage conditions that under other storage conditions because, during partial-storage periods, a greater range of areas of exposed island bottoms, reservoir sizes, and water depths can occur. Partial-storage reservoir conditions would range from saturated soils adjacent to reservoir shorelines to reservoir water depths of over 10 feet. Algae would be expected to become established under partial-storage conditions, as described for full storage. Under partial-storage conditions, exposed island bottoms would be largely unvegetated following drawdown from full storage. Vegetation conditions on exposed island bottoms would be expected to be similar to those described below for shallow-water wetland periods if partial storage occurs during the growing season.

Shallow Storage. Shallow storage occurs when stored water volumes are equal to water volumes used to create shallow-water wetlands. Vegetation conditions under shallow-water storage would be similar to those described for partial storage except that the areas of exposed island bottoms would be greater. Shallow storage that occurs following periods of nonstorage during the growing season would create vegetation conditions similar to those that would be created during shallow-water wetland periods (described below).

Nonstorage. Nonstorage conditions would occur during periods when no water is stored and water is not used to create shallow-water wetlands. The reservoir islands would consist of bare ground with little or no vegetation growth during nonstorage periods that follow full-storage periods from November through March. During periods of nonstorage from April through October, plants would be expected to germinate within the first 30 days of nonstorage, although bare ground would be the predominant condition. Vegetation would grow rapidly following germination. Vegetation types and density would be similar to those described for shallow-water wetlands.

Shallow-Water Wetlands. Shallow-water wetland conditions could exist during periods when no storage occurs and water is diverted onto the reservoir islands to flood vegetation and attract waterfowl and other wetland-associated wildlife. Shallow-water wetlands would be created at DW's discretion. For this analysis, however, it was assumed that DW would create shallow-water wetlands in every year in which no water has been stored for 60 or more consecutive days during the growing season (May through October).

Shallow-water wetlands would be managed until the first period of water storage (including storage of water diverted for transfer or banking) or through April if no storage occurs. Wetlands would be flooded between September and November (flooding dates would vary with vegetation maturity) to create shallow-water wetlands. DW will construct an inner-levee system on reservoir islands that would restrict flooding to allow creation of shallow-water wetlands on at least 65% of each reservoir island, 50% of which would maintain mean water depths of 1 foot and allow water to circulate through wetlands.

Grasses, forbs, and emergents are expected to be the dominant plant species of the shallow-water wetlands. The rate at which herbaceous vegetation would become reestablished on the reservoir islands following complete or partial drawdowns of stored water during the growing season is unknown. The vegetation would be sparse because seed sources for future plant crops are expected to be depleted during storage periods as a result of diminished seed viability with extended periods of inundation, export of seeds from islands during releases, and reduced seed crops produced on the islands.

At DW's discretion, reservoir islands may be seeded with watergrass, smartweed, and other important waterfowl forage plant species. If seeded, wetlands and exposed areas would have much denser vegetation than without seeding, and the availability of forage for waterfowl and other wildlife would be increased.

Levee Slopes and Roads. Recently maintained exterior riprapped slope banks generally would remain unvegetated. Vegetation on undisturbed riprapped

slopes would be sparse and would include annual and perennial herbaceous species, along with woody species, such as sandbar willow and button bush.

DW would reinforce reservoir island levees using a variety of methods (see Chapter 3D, "Flood Control"). Depending on the method used, between 133 aces and 380 acres of levee area would be riprapped and total levee slopes would occupy between 380 acres and 446 acres. Little or no vegetation would be expected to become established along riprapped porions of inner levee slopes that would be inundated during storage periods. The upper 4 feet of the inner levee would never be inundated; therefore, vegetation similar to that described for the exterior levee slopes may eventually become established. Vegetation similar to that described for shallow-water wetlands would be expected to become established on unriprapped levee slopes during nonstorage periods. Levee vegetation would be disturbed periodically in future years as a result of levee maintenance activities.

Generally, the 16-foot-wide levee roads would not support vegetation, except for Bermuda grass, sueda, star-thistle, and peppergrass growing in the center line. Little vegetation would survive the periodic disturbance and grading for road maintenance and levee crown repair.

Long-Term Soil Productivity. Environmental factors affecting soil conditions would be different under operation of Alternative 1 from factors under the present agricultural management regime. Differences include periods of deep water storage, the possible yearly accumulation of fine silt during the storage period, and the annual accumulation of vegetation biomass in the absence of agricultural harvest. In general, implementing the project could slow the rate of land subsidence and reduce the loss of soil productivity caused by oxidation and wind erosion on Delta islands (see Appendix G2, "Prediction of Vegetation on the Delta Wetlands Reservoir Islands").

Bouldin Island and Holland Tract

Habitat islands would be managed primarily to offset impacts on wetland and riparian habitats and wildlife on reservoir islands and habitat islands under Alternative 1. Table 3G-5 summarizes the habitat types and acreages to be created on the habitat islands. A detailed description of habitat types and management prescriptions for habitat island habitats is presented in Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands".

Changes in Vegetation Types

Bacon Island and Webb Tract

Under Alternative 1, agriculture would be discontinued on the reservoir islands and riparian and herbaceous upland habitats would be substantially reduced on the reservoir islands as a result of deep flooding during full-storage periods. Some riparian plant seedlings and herbaceous upland species would become established during nonstorage periods and would persist in areas not flooded to provide shallow-water wetlands until the next water storage event.

Marsh vegetation would be lost as a result of deep-water inundation. Marsh vegetation, such as tules and cattails, however, would be expected to become established during some years of extended nonstorage in shallow-water wetlands and areas that maintain saturated soils during extended nonstorage periods.

Bouldin Island and Holland Tract

Table 3G-6 summarizes changes in habitat types that would occur on the habitat islands under Alternative 1 with implementation of the HMP. Agricultural acreage would be reduced and crops would be limited to corn, wheat, and other small grains.

The acreage of freshwater emergent marsh and riparian woodland and scrub habitats would be substantially increased (Table 3G-6). Exotic marsh habitat affected by the project would be replaced with seasonal managed wetland, mixed agriculture/seasonal wetland, and seasonal pond habitats. These out-of-kind habitats will provide substantially higher wildlife values than do the affected exotic marsh habitats (Chapter 3H, "Wildlife"). Two large permanent lakes designed to provide functions and values similar to those of the two blowout ponds on Webb Tract would be established on Bouldin Island. The acreage of herbaceous upland would be slightly reduced under Alternative 1.

The quality of wildlife habitat under Alternative 1 would be substantially higher than that of comparable habitat types under existing conditions because habitats

would be managed specifically to provide maximum benefits for wildlife (see Chapter 3H, "Wildlife", and Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands").

Section 404 Jurisdictional Wetlands

Approximately 567 acres of jurisdictional wetlands would be lost under Alternative 1, primarily on the reservoir islands (Appendix G5, "Summary of Jurisdictional Wetland Impacts and Mitigation"). Direct impacts on jurisdictional wetlands would result from dredge and fill activities associated with placement of pumps and siphons, refurbishment of levees, and grading activity for construction of wildlife habitats on the habitat islands. Indirect impacts on jurisdictional wetlands associated with dredge and fill activities would result from water storage on the reservoir islands.

To offset impacts on jurisdictional wetlands, mitigation wetlands would be constructed on the habitat islands at replacement acreage ratios established by the HMP team (Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands", and Appendix G5, "Summary of Jurisdictional Wetland Impacts and Mitigation"). Approximately 711 acres of riparian, marsh, and seasonal wetland habitats are required to be established on the habitat islands to offset impacts. Under Alternative 1, approximately 3,900 more acres of emergent marsh and seasonal wetland habitats would be established than are required to mitigate losses of jurisdictional freshwater exotic marsh habitats.

Summary of Project Impacts and Recommended Mitigation Measures

Impact G-1: Increase in Freshwater Marsh and Exotic Marsh Habitats. Implementing Alternative 1 would result in the loss of approximately 27 acres of freshwater marsh and 147 acres of exotic marsh that have been delineated as jurisdictional wetlands. The HMP team, in consultation with USACE, established a mitigation requirement of replacing the acreage of these affected habitats at a ratio of 2:1 (Table G5-7 in Appendix G5). Implementing the HMP on the habitat islands would replace affected freshwater marsh with approximately 350 acres of tule-dominated emergent marsh (a replacement ratio of 13:1) and would replace affected exotic marsh with 3,761 acres of out-of-kind seasonal managed wetland and mixed agriculture/seasonal wetland (a replacement ratio of 26:1), which will provide higher wildlife values than existing exotic marsh habitat (see Appendices G3 and G5). Therefore, this impact is considered beneficial.

Mitigation. No mitigation is required.

Impact G-2: Loss of Riparian and Permanent Pond Habitats. Approximately 48 acres of cottonwood-willow woodland (i.e., riparian woodland), 61 acres of willow scrub (i.e., riparian scrub), and 98 acres of permanent pond habitat would be lost with implementation of Alternative 1. The HMP team, in consultation with USACE, established mitigation objectives of replacing the affected acreage of riparian woodland at a ratio of 3:1, riparian scrub at a ratio of 2:1, and permanent ponds at a ratio of 1:1. These mitigation objectives will be met or exceeded with the establishment of approximately 143 acres of riparian woodland, 122 acres of riparian scrub, and 111 acres of permanent lake habitats on the habitat islands (see Appendices G3 and G5). Therefore, this impact is considered less than significant.

Mitigation. No mitigation is required.

Impact G-3: Loss of Upland and Agricultural Habitats. Approximately 188 acres of jurisdictional wetlands that supported canal and ditch, grain and seed crop, annual grassland, exotic perennial grassland, and unvegetated disturbed habitats would be affected by project implementation. DW will manage 7,335 acres of similar habitats on the habitat islands; these managed habitats will provide greater wildlife values than are associated with affected habitats (see Appendices G3 and G5). Mitigation habitats to be constructed on the habitat islands include corn/wheat fields, seasonal managed wetlands, mixed agriculture/seasonal wetlands, small grain fields, herbaceous uplands, and canals and ditches necessary to manage these habitats. Therefore, this impact is considered less than significant.

Mitigation. No mitigation is required.

Indirect Offsite Effects on Vegetation Attributable to Changes in Delta Outflow

Concern exists that increased diversions of water from the Delta may reduce Delta outflow, thereby causing changes in salinity levels in tidal and brackish habitats around Suisun Bay and in Suisun Marsh. Chapter 3B, "Hydrodynamics", and Chapter 3C, "Water Quality", describe changes in outflow and salinity, respectively, predicted to result from project operations. As presented in those chapters, changes in outflow or salinity that may occur during diversion or discharge periods would be small. The predicted small changes in outflow and salinity are not expected to cause adverse effects on offsite wetland vegetation.

As described in Chapter 2, "Delta Wetlands Project Alternatives", DW has removed construction of recreation facilities from its CWA permit applications, and USACE will not include the construction of such facilities in permits issued for the project at this time. Nevertheless, the analysis of impacts on special-status plants presented below assumes that the recreation facilities would be constructed and operated. The information presented in this chapter provides readers with a complete record of the environmental analysis; it may be used in any subsequent environmental assessment of the recreation facilities.

Special-Status Plant Species

No populations of special-status plant species were found in the interior portions of the DW project islands. Because conditions that favor special-status plant species have not developed on the DW project islands since surveys were conducted, it is unlikely that populations of special-status plants have become established on the islands. Therefore, changes of habitat on the islands caused by water storage would not have an impact on populations of special-status plants.

As described in Chapter 2, "Delta Wetlands Project Alternatives", DW has removed construction of recreation facilities from its CWA permit applications, and USACE will not include the construction of such facilities in permits issued for the project at this time. Nevertheless, the analysis of impacts on special-status plants presented below assumes that the recreation facilities would be constructed and operated. The information presented in this chapter provides readers with a complete record of the environmental analysis; it may be used in any subsequent environmental assessment of the recreation facilities.

Bacon Island and Webb Tract

Two populations of rose-mallow exist at or near the proposed locations of recreation facilities, and three populations of Mason's lilaeopsis are near proposed locations of recreation facilities on Bacon Island. Two populations of Suisun Marsh aster and one population of Mason's lilaeopsis are located within 100-200 feet of proposed recreation facilities on Webb Tract.

Bouldin Island and Holland Tract

One population of rose-mallow exists near the proposed location of a recreation facility on Bouldin Island. Two populations of the Suisun Marsh aster are located near proposed recreation facilities, and another Suisun Marsh aster population is located within 100-200 feet of a proposed pump station.

One population each of Suisun Marsh aster, Delta tule pea, and Mason's lilaeopsis is located near proposed recreation facilities on Holland Tract.

Summary of Project Impacts and Recommended Mitigation Measures

Impact G-4: Loss of Special-Status Plants. There are five special-status plant species on the DW project islands that are federally listed as category 2 species, state-listed as rare, or listed as locally or regionally uncommon by CNPS. Implementing Alternative 1 could cause the loss of special-status plants resulting from siting of a pump station, siphon station, recreation facility, or other DW project facility on a site occupied by a special-status plant population. Therefore, this impact is considered significant.

Implementing Mitigation Measures G-1, G-2, and G-3 would reduce Impact G-4 to a less-than-significant level.

Mitigation Measure G-1: Site Project Facilities to Avoid Special-Status Plant Populations. DW shall conduct special-status plant surveys before con-

struction of project facilities and shall site facilities to avoid special-status plant populations.

Mitigation Measure G-2: Protect Special-Status Plant Populations from Construction and Recreational Activities. To mitigate potential indirect impacts of construction, DW shall use several measures to protect special-status plants that are within 200 feet of project facility sites. First, the boundaries of each population shall be determined and marked with surveyor's flagging. Second, special-status plants within 100 feet of project facility sites shall be protected by temporary barricades erected 50 feet from the edge of the population nearest to the facility site. Plants 100-200 feet from the construction sites shall be identified with brightly colored flagging on vegetation and/or surveyor's stakes that are plainly visible to construction personnel approaching the area occupied by the plants. Flagging shall not be obscured by vegetation. Construction crews and DW maintenance personnel must be informed of the presence of the plants, the function of the barricades and flagging, and the strict avoidance requirements.

Areas that support special-status plant populations shall not be open to recreation. If special-status plant populations are inadvertently affected by construction or recreational uses, DW shall contact DFG and negotiate appropriate mitigation to offset impacts, including development of a mitigation monitoring program and performance standards.

Mitigation Measure G-3: Develop and Implement a Special-Status Plant Species Mitigation Plan. DW, in consultation with SWRCB, DFG, and USFWS, shall develop and implement a plan for mitigating unavoidable impacts on special-status plant populations. No diversion shall be permitted until California Endangered Species Act consultations have been completed, a no-jeopardy opinion has been issued by DFG, and a mitigation plan and mitigation implementation schedule have been approved by SWRCB's Chief of the Division of Water Rights.

IMPACTS AND MITIGATION MEASURES OF ALTERNATIVE 2

Impacts and mitigation measures of Alternative 2 are the same as those of Alternative 1.

IMPACTS AND MITIGATION MEASURES OF ALTERNATIVE 3

Alternative 3 involves storage of water on Bacon Island, Webb Tract, Bouldin Island south of SR 12, and Holland Tract, with secondary uses for wildlife habitat and recreation. Reservoir islands would be managed during fall, winter, and spring nonstorage periods as seasonal wetlands. The portion of Bouldin Island north of SR 12 would be managed as a wildlife habitat area (NBHA).

Vegetation Conditions

Bacon Island, Webb Tract, Bouldin Island South of SR 12, and Holland Tract

Vegetation conditions on the reservoir islands under Alternative 3 would be similar to conditions under Alternative 1 on Bacon Island and Webb Tract for each of the storage condition classes (see Appendix G2, "Prediction of Vegetation on the Delta Wetlands Reservoir Islands").

North Bouldin Habitat Area

The portion of Bouldin Island north of SR 12 would be managed as the NBHA under Alternative 3. Approximately 50 acres of perennial ponds, 330 acres of seasonal managed wetlands, 170 acres of corn, 200 acres of riparian woodland, and 125 acres of herbaceous uplands would be established and managed for wildlife in the NBHA (see Appendix G2).

Habitat conditions for the NBHA are the same as those described for Bouldin Island and Holland Tract under Alternative 1. Detailed descriptions of how these habitats would be managed are presented in Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands".

Changes in Vegetation Types

Bacon Island, Webb Tract, Bouldin Island South of SR 12, and Holland Tract

Changes in vegetation types on the reservoir islands under Alternative 3 would be the same as those described for the reservoir islands under Alternative 1, except that an additional 1,113 acres of riparian, exotic marsh, herbaceous upland, agricultural, open water, and developed habitats in the southwestern quarter of Holland Tract would also be lost as a result of water storage (Table 3G-4).

North Bouldin Habitat Area

Agriculture would be substantially reduced in the NBHA under Alternative 3. Agricultural habitats would be converted to perennial pond, seasonal managed wetland, riparian woodland, and herbaceous upland habitats.

Section 404 Jurisdictional Wetlands

Under Alternative 3, jurisdictional wetlands would be lost as a result of placement of water operation facilities (e.g., pumps and siphons), land grading and levee improvements, and water storage operations on the reservoir islands.

Summary of Project Impacts and Recommended Mitigation Measures

Impact G-5: Loss of Jurisdictional Wetlands on Reservoir Islands. Implementing Alternative 3 would result in the loss from the reservoir islands of the following wetlands subject to Section 404 jurisdiction: approximately 203 acres of riparian woodland and riparian scrub, 56 acres of freshwater marsh, 147 acres of exotic marsh, 111 acres of perennial ponds, and 188 acres of upland and agricultural habitats. These losses would partially be offset with development of Section 404 wetland habitats on the NBHA. Substantial losses of jurisdictional wetland acreage, however, would still occur because of inundation of the reservoir islands (Table 3G-4). Therefore, this impact is considered significant.

Implementing Mitigation Measure G-4 would reduce Impact G-5 to a less-than-significant level.

Mitigation Measure G-4: Develop and Implement an Offsite Mitigation Plan. DW, in consultation with SWRCB, USACE, DFG, and USFWS, shall implement an offsite mitigation plan for mitigating impacts on Section 404 jurisdictional wetlands that would result from implementation of Alternative 3. Once DW has identified offsite mitigation areas, an HMP team, composed of representatives approved by SWRCB, shall be established to develop the offsite mitigation plan. No diversions would be allowed until a feasible compensation plan that guarantees compensation acreage has been developed by DW and approved by USACE and SWRCB.

Indirect Offsite Effects on Vegetation Attributable to Changes in Delta Outflow

As described above for Alternative 1, changes in outflow or salinity that may occur during diversion or discharge periods would be small (see Chapter 3B, "Hydrodynamics", and Chapter 3C, "Water Quality"). These changes are not expected to cause adverse effects on offsite wetland vegetation.

Special-Status Species

The impact and mitigation measures of Alternative 3 related to special-status plants are the same as those described for Alternative 1.

Summary of Project Impacts and Recommended Mitigation Measures

Impact G-6: Loss of Special-Status Plants. This impact on the DW project islands is described above under Impact G-4. This impact is considered significant.

Implementing Mitigation Measures G-1, G-2, and G-3 (described above under "Impacts and Mitigation Measures of Alternative 1") would reduce Impact G-6 to a less-than-significant level.

Mitigation Measure G-1: Site Project Facilities to Avoid Special-Status Plant Populations

Mitigation Measure G-2: Protect Special-Status Plant Populations from Construction and Recreational Activities

Mitigation Measure G-3: Develop and Implement a Special-Status Plant Species Mitigation Plan

IMPACTS AND MITIGATION MEASURES OF THE NO-PROJECT ALTERNATIVE

The project applicant would not be required to implement mitigation measures if the No-Project Alternative were selected by the lead agencies. However, mitigation measures are presented for impacts of the No-Project Alternative to provide information to the reviewing agencies regarding the measures that would reduce impacts if the project applicant implemented a project that required no federal or state agency approvals. This information would allow the reviewing agencies to make a more realistic comparison of the DW project alternatives, including implementation of recommended mitigation measures, with the No-Project Alternative.

Vegetation Conditions

Implementation of the No-Project Alternative would involve intensive agricultural use of the DW project islands and would substantially change habitats on the DW project islands compared with habitats under existing conditions. In general, the impacts would result primarily from conversion of fallow, herbaceous upland, riparian, and wetland habitats to agricultural use (see Appendix G2, "Predictions of Vegetation on the Delta Wetlands Reservoir Islands").

Changes in Vegetation Types

Implementation of the No-Project Alternative would result in conversion of large acreages of corn and wheat crops to potatoes, onions, asparagus, and vineyards on Bacon and Bouldin Islands. Substantial acreages of fallow, exotic marsh (i.e., agricultural weeds growing in saturated soils), and pasture habitat on Holland and Webb Tracts would be converted to corn and wheat. Efficiency of harvest for corn and other seed crops would increase; thus, amounts of waste corn per acre left on Holland and Webb Tracts would be expected to decline to the levels measured on Bouldin Island (105 pounds per acre).

Under the No-Project Alternative, agricultural land use on the DW project islands would increase an estimated 20% (by about 3,000 acres) at the expense of other existing land uses and vegetation types (see Appendix G2). Riparian woodland and riparian scrub would decrease by 50%, and freshwater marsh would decrease by more than 80%.

The changes in agricultural cropping patterns and habitat-type acreages described for this alternative were implemented to a large extent by DW between December 1987 and October 1990.

Section 404 Jurisdictional Wetlands

Under Section 404(f)(1) of the Clean Water Act, normal farming activities, such as plowing, seeding, cultivating, and maintaining drainage ditches, are exempt from Section 404 permit requirements as long as surface materials are not redistributed by blading or grading to fill a Section 404 jurisdictional wetland area. The No-Project Alternative is thus limited to those farming activities to increase cropping intensity that could be implemented without a Section 404 permit. Therefore, implementing the No-Project Alternative would not affect jurisdictional wetlands.

Special-Status Species

Increasing agricultural production under the No-Project Alternative would not result in direct impacts on special-status plants. However, over the long term, increased rates of subsidence on the DW project islands from extensive soil oxidation would require levees to be maintained and built to greater heights. (See Chapter 3D, "Flood Control", for more detail on island subsidence.) More intensive levee maintenance by reclamation districts and farmers could conceivably eliminate special-status plants.

Summary of Project Impacts and Recommended Mitigation Measures

Loss of Special-Status Plants. Implementing the No-Project Alternative could result in the loss of special-status plants through perimeter levee maintenance activities. Implementing the following measure would reduce this effect of the No-Project Alternative.

Protect Special-Status Plant Populations from Levee Maintenance Activities. DW should conduct special-status plant surveys before initiating levee maintenance activities to locate special-status plant populations. Where feasible, construction should be sited to avoid special-status plant populations. If special-status plant populations cannot be avoided, they should be protected from potential indirect impacts of construction as described for Mitigation Measure G-2 above.

Develop and Implement a Special-Status Plant Species Mitigation Plan. DW should develop and implement a mitigation plan that would mitigate unavoidable impacts on special-status plant populations. This measure is described above as Mitigation Measure G-3.

CUMULATIVE IMPACTS

This section briefly analyzes cumulative impacts for major vegetation and wetland issues. The analysis identifies other projects or activities in the Delta region and surrounding areas that may affect habitats that may also be affected by the DW project. These projects are summarized in Appendix 2, "Supplemental Description of the Delta Wetlands Project Alternatives". Beneficial and negative cumulative effects are identified, and the overall effect of DW project impacts on regional habitats is described.

Cumulative Impacts, Including Impacts of Alternative 1

Changes in Reservoir Island Storage Conditions

DWR recently installed four additional pumping units at SWP's Banks Pumping Plant near Clifton Court Forebay, increasing total SWP pumping capacity from 6,400 cfs to 10,300 cfs. If SWP export pumping is increased to full capacity in future years, the frequency with which each storage class would occur on the DW project islands would change. Tables 3G-5 and 3G-6 present the storage class frequencies for the reservoir islands under the 1995 DEIR/EIS cumulative scenario for Alternative 1 based on the 70-year hydrologic record for the Delta. In most months the frequency with which full-, partial-, and shallow-storage conditions would occur would be reduced and the occurrence of nonstorage conditions and the opportunity to create shallow-water wetland conditions would be increased.

Wetland Habitats and Special-Status Plants

Related past, present, and foreseeable future projects may contribute cumulatively to the vegetation impacts identified in this chapter by causing loss or damage to riparian and wetland vegetation types and to special-status plant species. Related past activities in the Delta that have caused cumulative losses of these vegetation resources include levee construction and repair, channel dredging, channel bank riprapping, island drainage, island reclamation for agriculture, and infrastructure construction on the islands (e.g., roads, pump stations, drainage ditches, and equipment buildings).

The cumulative historical loss of riparian woodland, riparian scrub, and freshwater and brackish marsh habitat types in the Delta since initial reclamation began is presumably equivalent to the 530,000 acres now in agriculture (Madrone Associates 1980). This cumulative historical loss amounts to more than 90% of the original extent of these habitats in the Delta.

Under state and federal policies regarding wetlands and special-status plant protection, any further losses of vegetation resources potentially caused by these projects will be avoided or fully compensated for. If such avoidance and mitigation occur, no further cumulative losses of these vegetation resources will take place.

The following foreseeable future projects that would compensate for wetland impacts in the Delta have the potential to increase riparian and wetland habitats along Delta channels, on Delta levees, and on Delta islands:

- # Interim South Delta Program (DWR and Reclamation 1990),
- # Interim North Delta Program,
- # Sherman Island Wildlife Management Plan (DWR 1990a),
- # Twitchell Island Wildlife Management Plan,
- # levee rehabilitation under the Delta Flood Protection Act (DWR 1990b), and
- # the CALFED Bay-Delta Program.

Impact G-7: Increase in Wetland and Riparian Habitats in the Delta. Implementation of Alternative 1 in conjunction with implementation of other Delta projects (see above) would result in an increase in the acreage of permanent and seasonal wetlands and riparian habitat in the Delta. In addition to the DW project, other planned Delta projects would either protect existing wetland and riparian habitats or create new habitats as mitigation to offset wetland and riparian habitat losses associated with past or future projects. Therefore, this impact is considered beneficial.

Mitigation. No mitigation is required.

Cumulative Impacts, Including Impacts of Alternative 2

The cumulative impact of Alternative 2 would be the same as that described for Alternative 1.

Cumulative Impacts, Including Impacts of Alternative 3

Other projects and activities in the Delta and surrounding regions that, in combination with Alternative 3, may result in cumulative impacts on vegetation are the same as described above for cumulative impacts with Alternative 1.

Section 404 Jurisdictional Emergent Wetland and Riparian Habitats

Water management and flood control projects could reduce the amounts of emergent wetland and riparian habitats in the Delta region. Alternative 3 would contribute to this impact by reducing emergent wetland and riparian habitats by approximately 72 acres on the DW project islands, but implementation of recommended offsite mitigation could fully compensate for this loss. Cumulative emergent wetland and riparian habitat losses would be offset by habitat restoration and subsidence control projects proposed in the Delta.

Impact G-8: Cumulative Loss of Section 404 Jurisdictional Emergent Wetland and Riparian Habitats. Implementation of water management and flood control projects (including implementation of Alternative 3) could reduce the amount of emergent wetland and riparian habitats in the Delta region. However, this loss would be offset by implementation of habitat restoration, subsidence control, and habitat compensation proposed as part of those projects or as a separate project. Therefore, this impact is considered less than significant.

Mitigation. No mitigation is required.

Cumulative Impacts, Including Impacts of the No-Project Alternative

Implementing the No-Project Alternative would not contribute to cumulative effects on vegetation resources in the Delta.

CITATIONS

References to the Code of Federal Regulations (CFR) and the Federal Register (FR) are not included in this list. CFR citations in text refer to title and section (50 CFR 17.12 refers to Title 50 of the CFR, Section 17.12). FR citations in text refer to volume and page numbers (55 FR 6184 refers to Volume 55 of the FR, page 6184).

Printed References

California. Department of Fish and Game. 1984. Guidelines for assessing effects of proposed developments on rare and endangered plants and plant communities. Sacramento, CA. Unpublished report.

_____. Department of Water Resources. 1990a. Initial study and negative declaration for proposed Sherman Island Wildlife Management Plan. Division of Planning. Sacramento, CA.

_____. Department of Water Resources. 1990b. Actions and priorities: Delta Flood Protection Act - eight western Delta islands. Sacramento, CA.

_____. Department of Water Resources and U.S. Bureau of Reclamation. 1990. Draft environmental impact report/environmental impact statement: South Delta Water Management Program. Sacramento, CA.

California Native Plant Society. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. Sacramento, CA.

Dains, V. 1988. Bedford Properties Delta Island project: results of a survey for special-status plants. Fair Oaks, CA. Prepared for Jones & Stokes Associates, Inc., Sacramento, CA.

Jones & Stokes Associates, Inc. 1988. Habitat type mapping: Bedford Properties Delta islands project. Final. (JSA 87-119.) Sacramento, CA. Prepared for Bedford Properties, Lafayette, CA.

Madrone Associates. 1980. Sacramento/San Joaquin Delta wildlife habitat protection and restoration plan. Novato, CA. Prepared for California Department of Fish and Game and U.S. Fish and Wildlife Service, Sacramento, CA.

Natural Diversity Data Base. 1987. Records search for the Delta Wetlands project area. California Department of Fish and Game, Sacramento, CA.

_____. 1993. Records search for the Delta Wetlands project islands. California Department of Fish and Game. Sacramento, CA.

Smith, J. P., Jr., and K. Berg. 1988. Inventory of rare and endangered vascular plants of California. 4th edition. (Special Publication No. 1.) California Native Plant Society. Sacramento, CA.

Personal Communications

Kjeldsen, Kenneth L. Consulting civil engineer. Kjeldsen-Sinnock & Associates, Inc., Stockton, CA. October 26, 1988, and September 1, 1989—telephone conversations.

McCarty, Patrick. President. The McCarty Company, Stockton, CA. July 12, 1988—letter.

Messersmith, James. Regional manager. California Department of Fish and Game, Region 2, Rancho Cordova, CA. October 23, 1987—letter to John Winther.

Table 3G-1. Special-Status Plants Potentially Occurring on the DW Project Islands

Scientific and Common Names	Status[a] Federal/State/CNPS	Distribution	Habitat
Aster lentus[b] Suisun Marsh aster (Asteraceae - sunflower family)	C2/--/1B	San Francisco, San Pablo, and Suisun Bays and the Delta in Contra Costa and Solano Counties, and San Joaquin Valley	Brackish, salt, and freshwater marshes at or above the zone of tidal fluctuation
Cirsium crassicaule Slough thistle (Asteraceae - sunflower family)	C2/--/1B	Delta and San Joaquin Valley to Kern County	Shallow water or saturated soils in various wetland plant communities along sloughs, canals, and rivers; often in disturbed areas
Erysimum capitatum var. *angustatum* Contra Costa wallflower (Brassicaceae - mustard family)	E/E/1B	Known only from the Antioch Dunes in the City of Antioch	Interior dunes with sparse herb and shrub cover
Eryngium racemosum Delta button-celery (Apiaceae - carrot family)	C2/E/1B	San Joaquin Valley and Delta from Merced County to San Joaquin County	Vernal pools and other seasonal wetlands on floodplains
Hibiscus lasiocarpus[b] Rose-mallow (Malvaceae - mallow family)	C2/--/2	Central Valley from Butte to San Joaquin Counties and adjacent Delta environs	Riparian habitats with freshwater marsh vegetation in areas with slow water velocities, such as canals, sloughs, ponds, and oxbow lakes
Lathyrus jepsonii ssp. *jepsonii*[b] Delta tule pea (Fabaceae - pea family)	C2/--/1B	Delta and Central Valley from Butte to Tulare Counties	River and canal banks in brackish and freshwater marshes and riparian woodlands, at or above the zone of tidal influence
Lathyrus palustus Marsh pea (Fabaceae - pea family)	--/--/3	Scant within widespread range throughout lowland and montane California	Freshwater marsh
Lilaeopsis masonii[b] Mason's lilaeopsis (Apiaceae - carrot family)	C2/R/1B	Suisun Bay and Delta within areas influenced by tidal fluctuations	Clay-peat deposits and rotting wood located in marsh vegetation along edges of waterways within the tidal zone
Limosella subulata[b] Delta mudwort (Scrophulariaceae - figwort family)	--/--/2	San Joaquin-Sacramento Delta	Edges of riverbanks and slough banks in marsh vegetation rooted within zone of tidal fluctuation
Oenothera deltoides var. *howellii* Antioch Dunes evening primrose (Onagraceae - primrose family)	E/E/1B	Known from the Delta at Antioch Dunes in the City of Antioch and Brannan Island	Interior dunes with sparse herb and shrub cover
Potamogeton zosteriformis Eel-grass pondweed (Potamogetonaceae - pondweed family)	--/--/2	Contra Costa County and various other northern California counties to Oregon and Washington	Open water of ditches, canals, and ponds
Psilocarphus brevissimus var. *globiferus* Tall woolly marbles (Asteraceae - sunflower family)	--/--/1B[b]	In San Francisco Bay and the Sacramento-San Joaquin Delta	Vernal pools and other seasonal wetlands
Sagittaria sanfordii Sanford's sagittaria (Alismataceae - arrowhead family)	C2/--/1B	Widespread but infrequent in the Central Valley and Coast Ranges	Sloughs and sluggish streams with silty or muddy substrate, associated with emergent marsh vegetation
Scutellaria laterifolia Mad-dog skullcap (Lamiaceae - mint family)	--/--/2	San Joaquin and Inyo Counties, New Mexico, and Oregon	Meadows and freshwater marsh

Table 3G-1. Continued

Note: -- = not applicable.

[a] Federal - U.S. Fish and Wildlife Service (50 FR 39526-39584, September 27, 1985):

E = listed as endangered under the federal Endangered Species Act.

C2 = Category 2 candidate species under review for federal listing for which the USFWS presently has some information indicating that listing is possibly appropriate, but for which further biological research is needed to determine threats. This category is administered by the amount of information available and not necessarily the status of the species.

State - California Department of Fish and Game (1988):

E = listed as endangered under the state Endangered Species Act.

R = listed as rare under the state Endangered Species Act.

CNPS - California Native Plant Society (Smith and Berg 1988):

1B = rare and endangered.

2 = List 2 species: rare, threatened, or endangered in California but more common elsewhere.

3 = List 3 species: plants about which more information is needed to determine their status.

[b] Observed on the DW project islands.

Table 3G-2. Populations of Special-Status Plant Species Observed on the DW Project Islands

Species	Bacon Island	Webb Tract	Holland Tract	Bouldin Island
Suisun Marsh aster	6	3	19	8
Mason's lilaeopsis	18	3	0	5
Rose-mallow	10	1	1	1
Delta tule pea	0	1	0	1

Note: All plants listed were observed on the exterior levee slopes along Delta channels.

Source: Dains 1988.

Table 3G-3. Habitat-Type Classification for the DW Project Islands

Habitat Group	Code	Description	Comments	Dominant or Typical Plant Species
Riparian	R1	Cottonwood-willow woodland	Cottonwood and willow trees	Fremont cottonwood, red willow, yellow willow
	R2	Great Valley willow scrub	Willow shrubs and trees	Red willow, yellow willow, sandbar willow, Goodding's willow
Marsh	M1	Freshwater marsh	Inside islands	Cattail, bulrush, yellow nutsedge, pondweed, buttonbush
	M2	Tidal marsh	Outside main islands	Common tule, common reed, Olney's bulrush, California bulrush, common rush
	M3	Exotic marsh[a]	Dense upland and wetland weeds (sometimes dry in summer)	Annual smartweed, peppergrass, amaranth, wild radish, nettles, cocklebur, watergrass
Woody, non-native	W1	Mature trees	Shade trees and windbreaks	Eucalyptus, pine, elm
	W2	Mixed ornamental	Shrubs and lawn	Turf grasses, miscellaneous ornamental shrubs
Herbaceous upland	H1	Annual grassland	True uplands and sand hills	Wild oats, barley, rip-gut brome, Italian rye-grass
	H2	Exotic perennial grassland[a]	Mixed weeds in fields and on levee slopes	Bermuda grass, perennial ryegrass, Johnson grass
Agriculture	A1	Grain and seed crops		Corn, wheat, sunflowers, potatoes
	A2	Perennial crops		Asparagus, vineyards
	A3	Pasture	Permanently grazed	Tall fescue, orchard grass, canary grass, ryegrass, legumes
	A4	Waterfowl food crops	Managed wetlands	Smartweed, watergrass, bulrush
	A5	Fallow	Short-term fallow fields	Yellow star-thistle, Russian thistle, houseweed, lamb's quarter, telegraph weed
Open water	O1	Canals and ditches	Permanent water	Dallis grass, knot grass, Himalaya berry, smartweed
	O2	Permanent ponds	Still water	Water hyacinth, water primrose, azolla
	O3	Mudflats	Tidal, open bare mud	None
Developed	D1	Structures	Buildings and marinas	
	D2	Paving and exposed earth	Roads, landfills, and unvegetated exposed areas	Largely unvegetated

[a] Exotic habitats are dominated by weedy plant species that are not native to the Delta.

Source: JSA 1988.

Table 3G-4. Acreages of Habitat Types on the DW Project Islands under the DW Project Alternatives and the No-Project Alternative

		Bacon Island, Webb Tract, and Bouldin Island (All Alternatives)						Holland Tract				All Islands			
		Bacon Island		Webb Tract		Bouldin Island		Alternatives 1 and 2		Alternative 3 and the No-Project Alternative		Alternatives 1 and 2		Alternative 3 and the No-Project Alternative	
Name	Code[a]	Acres	Percentage of Total	Acres	Percentage of Total	Acres	Percentage of Total	Acres	Percentage of Total	Acres	Percentage of Total	Acres	Percentage of Total	Acres	Percentage of Total
Riparian	R1	0.0	0.00	47.7	0.87	6.9	0.11	80.3	2.56	91.6	2.16	134.9	0.67	146.2	0.69
	R2	3.4	0.06	58.0	1.06	9.9	0.16	24.8	0.79	30.5	0.72	96.1	0.48	101.8	0.48
Marsh	M1	2.7	0.05	172.0	3.14	21.1	0.35	27.8	0.89	27.8	0.65	223.5	1.11	223.5	1.05
	M3	30.4	0.55	783.3	14.32	114.7	1.92	195.5	6.23	259.7	6.11	1,123.9	5.58	1,188.1	5.60
Woody, non-native	W1	0.0	0.00	0.0	0.00	2.8	0.05	4.4	0.14	4.4	0.10	7.2	0.04	7.2	0.03
	W2	0.0	0.00	0.0	0.00	2.2	0.04	0.0	0.00	0.0	0.00	2.2	0.01	2.2	0.01
Herbaceous upland	H1	260.8	4.71	534.6	9.77	349.1	5.83	369.0	11.77	396.3	7.07	1,513.5	7.52	1,540.8	7.25
	H2	267.6	4.83	304.2	5.56	0.0	0.0	263.8	8.41	263.8	6.21	835.6	4.15	835.6	3.93
Agriculture	A1 (corn)	775.8	14.00	2,222.9	40.64	2,459.2	41.09	131.8	4.20	238.2	5.61	5,589.7	27.77	5,696.1	26.82
	A1 (wheat)	0.0	0.00	445.0	8.14	1,182.8	19.76	482.5	15.39	879.5	20.70	2,110.3	10.48	2,570.7	12.10
	A1 (milo)	83.6	1.51	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	83.6	0.42	83.6	0.39
	A1 (potato)	1,882.6	33.99	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	1,882.6	9.35	1,882.6	8.86
	A1 (sunflower)	190.7	3.44	0.0	0.00	888.3	14.84	0.0	0.00	0.0	0.00	1,079.0	5.36	1,079.0	5.08
	A1 (unknown)	158.8	2.87	26.8	0.49	0.0	0.00	0.0	0.00	0.0	0.00	185.6	0.92	185.6	0.87
	A1 subtotal	3,091.5	55.81	2,694.7	49.27	4,530.3	75.69	614.3	19.59	1,117.7	26.31	10,930.8	54.30	11,497.6	54.13
	A2 (asparagus)	1,069.1	19.30	0.0	0.00	0.0	0.00.	423.0	13.49	423.0	9.96	1,492.1	7.41	1,492.1	7.02
	A2 (vineyard)	278.4	5.03	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	278.4	1.38	278.4	1.31
	A2 subtotal	1,347.5	24.33	0	0	0	0	423.0	13.49	423.0	9.96	1,770.5	8.80	1,770.5	8.34
	A3	0.0	0.00	61.0	1.12	34.2	0.57	349.8	11.16	570.7	13.43	445.0	2.21	665.9	3.13
	A5 (fallow)	355.3	6.41	637.9	11.66	711.6	11.89	689.1	21.98	784.7	18.47	2,394.0	11.89	2,489.6	11.72
Open water	O1	91.8	1.66	49.7	0.91	118.1	1.97	39.4	1.26	45.0	1.06	299.0	1.49	304.6	1.43
	O2	1.5	0.03	105.7	1.93	0.0	0.00	16.6	0.53	23.1	0.54	123.8	0.62	130.3	0.61
	O3	1.2	0.02	0.0	0.0	9.3	0.16	0.0	0.00	0.0	0.00	10.5	0.05	10.5	0.05
Developed	D1	12.6	0.23	1.5	0.03	4.2	0.07	9.0	0.29	12.4	0.29	27.3	0.14	30.7	0.14
	D2	73.1	1.32	18.7	0.34	70.6	1.18	28.4	0.91	134.2	5.42	190.8	0.95	296.6	1.40
Total		5,539.4	100.00	5,469.0	100.00	5,985.0	100.00	3,135.2	100.00	4,248.3	100.00	20,128.6	100.00	21,241.7	100.00

Note: Minor discrepancies in totals are the result of rounding.

[a] See Table 3G-3 for code definitions.

Table 3G-5. Acreages of Habitats to Be Developed on the Habitat Islands

Habitat Type	Bouldin Island		Holland Tract		Habitat Islands Combined	
	Total Acres	Percentage of Total Acres	Total Acres	Percentage of Total Acres	Total Acres	Percentage of Total Acres
Corn/wheat	1,629	27	955	31	2,584	29
Small grains	106	2	152	5	258	3
Mixed agriculture/seasonal wetland	1,014	17	631	21	1,645	18
Seasonal managed wetland	1,723	29	393	13	2,116	23
Seasonal pond	66	1	68	2	134	1
Pasture/hay	132	2	72	2	204	2
Emergent marsh[a]	208	3	194	6	402	4
Riparian[a]	170	3	217	7	387	4
Lake[a]	111	2	33	1	144	2
Herbaceous upland[a]	479	8	253	8	732	8
Developed	177	3	58	2	235	3
Canal[a]	70	1	10	0	80	1
Borrow pond	89	1	0	0	89	1
Total	5,974	100	3,036	100	9,010	100

Note: Minor discrepancies in totals are the result of rounding.

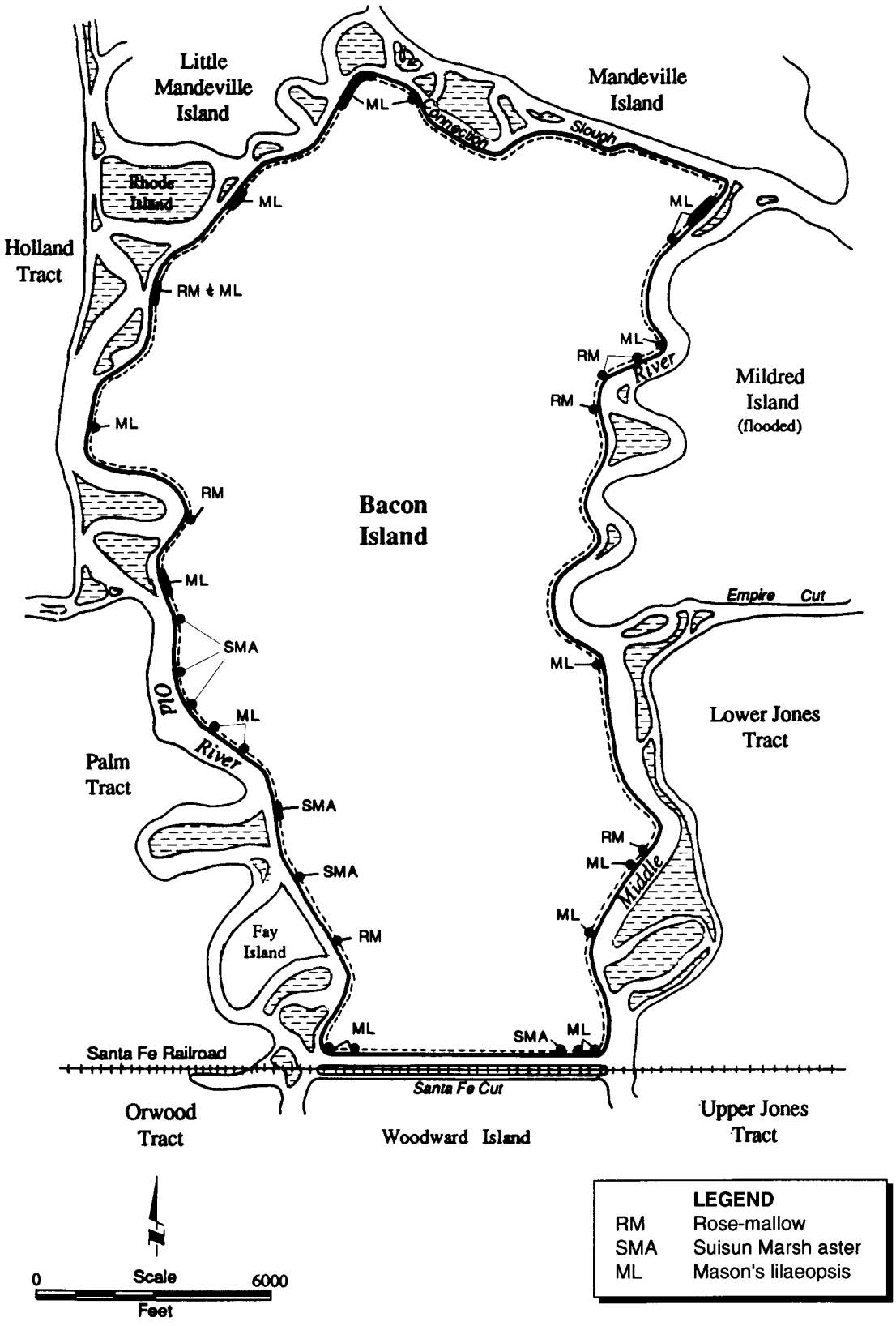
[a] Includes existing acres of habitat unaffected by the DW project.

Table 3G-6. Changes in Habitat Acreages from Existing Conditions to Conditions under Alternatives 1 and 2

Affected Habitat Type	Corresponding Habitat Island Habitat Type	Existing Conditions		Alternatives 1 and 2[a]		Change from Existing to DW Project Conditions	
		Reservoir Islands (acres)	Habitat Islands (acres)	Reservoir Islands (acres)	Habitat Islands (acres)	Acres	Percentage
Riparian woodland	Riparian woodland	48	87	0.0	230	+95	+70.3
Riparian scrub	Riparian scrub	61	35	0.0	157	+61	+63.5
Freshwater marsh	Emergent marsh	175	49	0.0[b]	402	+178	+79.9
Exotic marsh	Mixed agriculture/seasonal wetland Seasonal managed wetland Seasonal pond	814	310	0.0[b]	3,895	+2,771	+246.5
Herbaceous upland	Herbaceous upland	1,367	982	0.0[b]	732	-1,617	-68.8
Corn, wheat, and milo	Corn rotated with wheat Small grains	3,527	4,193	0.0	2,842	-4,878	-63.2
Pasture	Pasture/hay	61	384	0.0	204	-241	-54.2
Other crops and fallow fields	None	4,600	2,775	0.0	0	-7,375	-100.0
Canals and ditches	Canal	142	158	0.0	80	-220	-73.3
Permanent pond	Permanent lake and borrow areas	107	17	0.0[b]	233	+109	+88.2
Total or average		10,902	8,990	0.0[b]	8,775	-11,117	-55.9

[a] See Impacts G-1, G-2, and G-3; Chapter 3H, "Wildlife"; and Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands", for a description of how compensation for project impacts on wildlife associated with these habitats would be achieved (regarding habitat quality versus quantity).

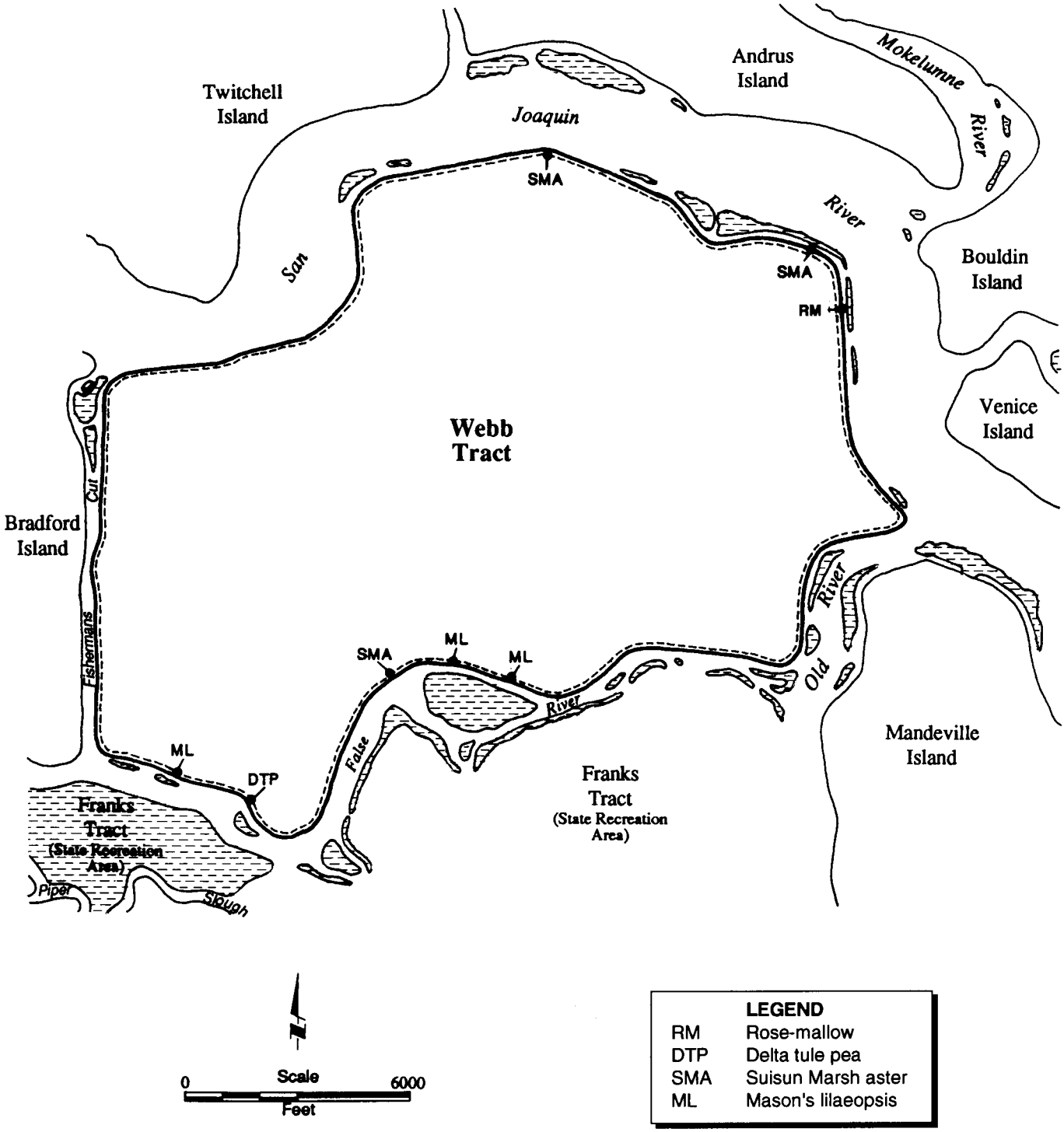
[b] These habitats would exist on reservoir islands during some operating years; however, because the areal extent of these habitat types and the frequency with which they would appear is unpredictable, no habitat acreage is credited.



Source: Dains 1988.

Jones & Stokes

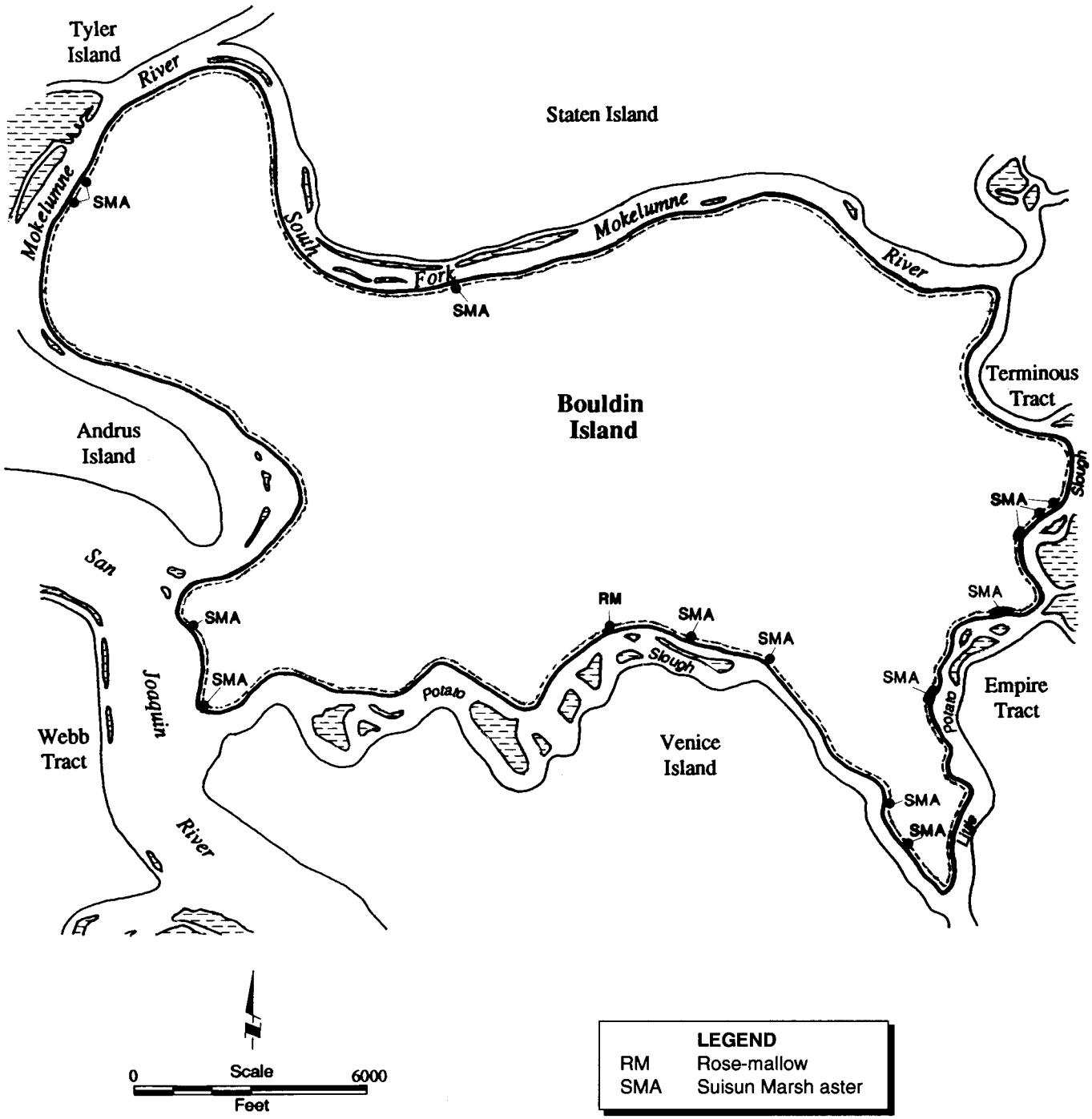
Figure 3G-1
Special-Status Plant Populations on Bacon Island



Source: Dains 1988.

Jones & Stokes

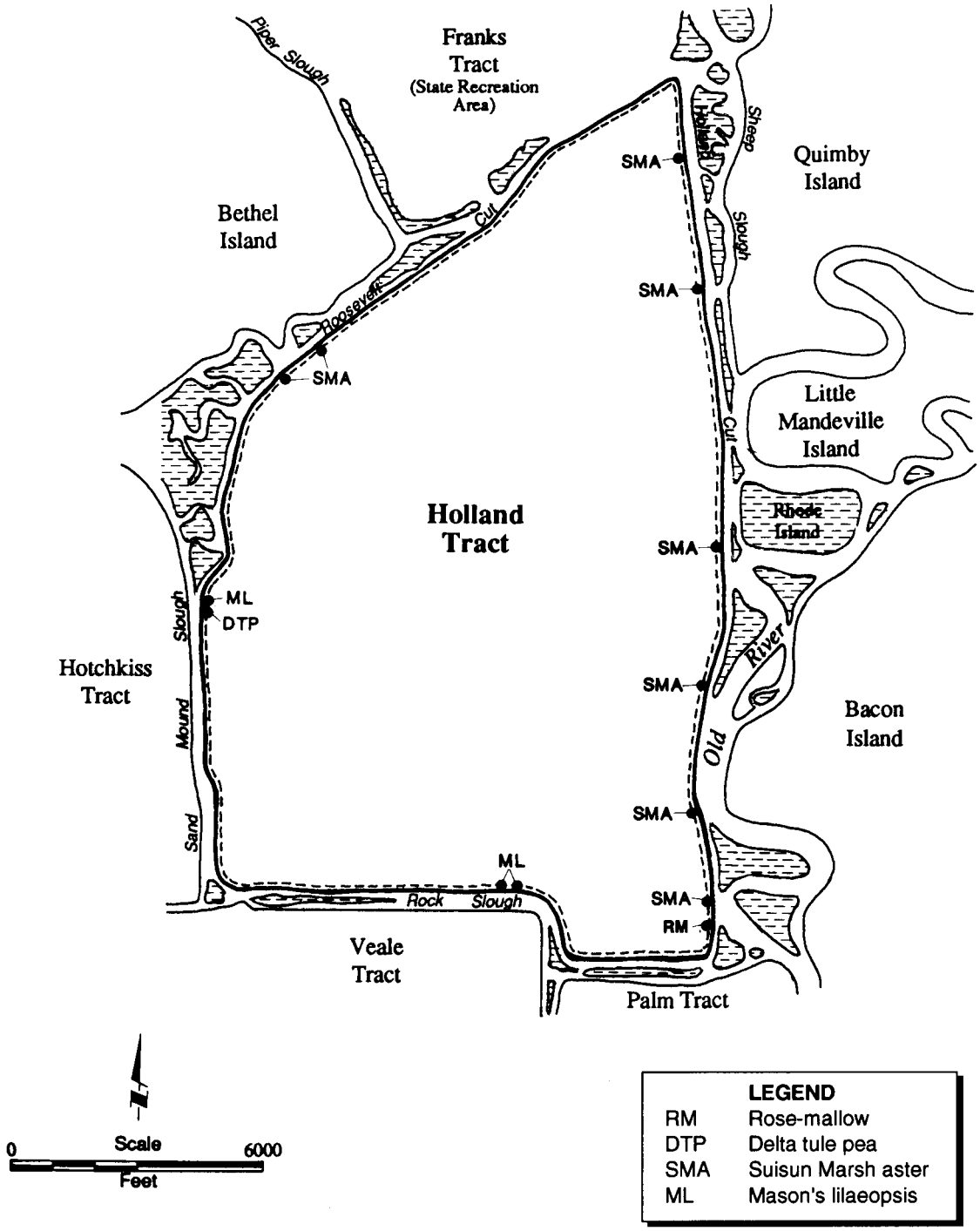
Figure 3G-2
Special-Status Plant Populations on Webb Tract



Source: Dains 1988.

Jones & Stokes

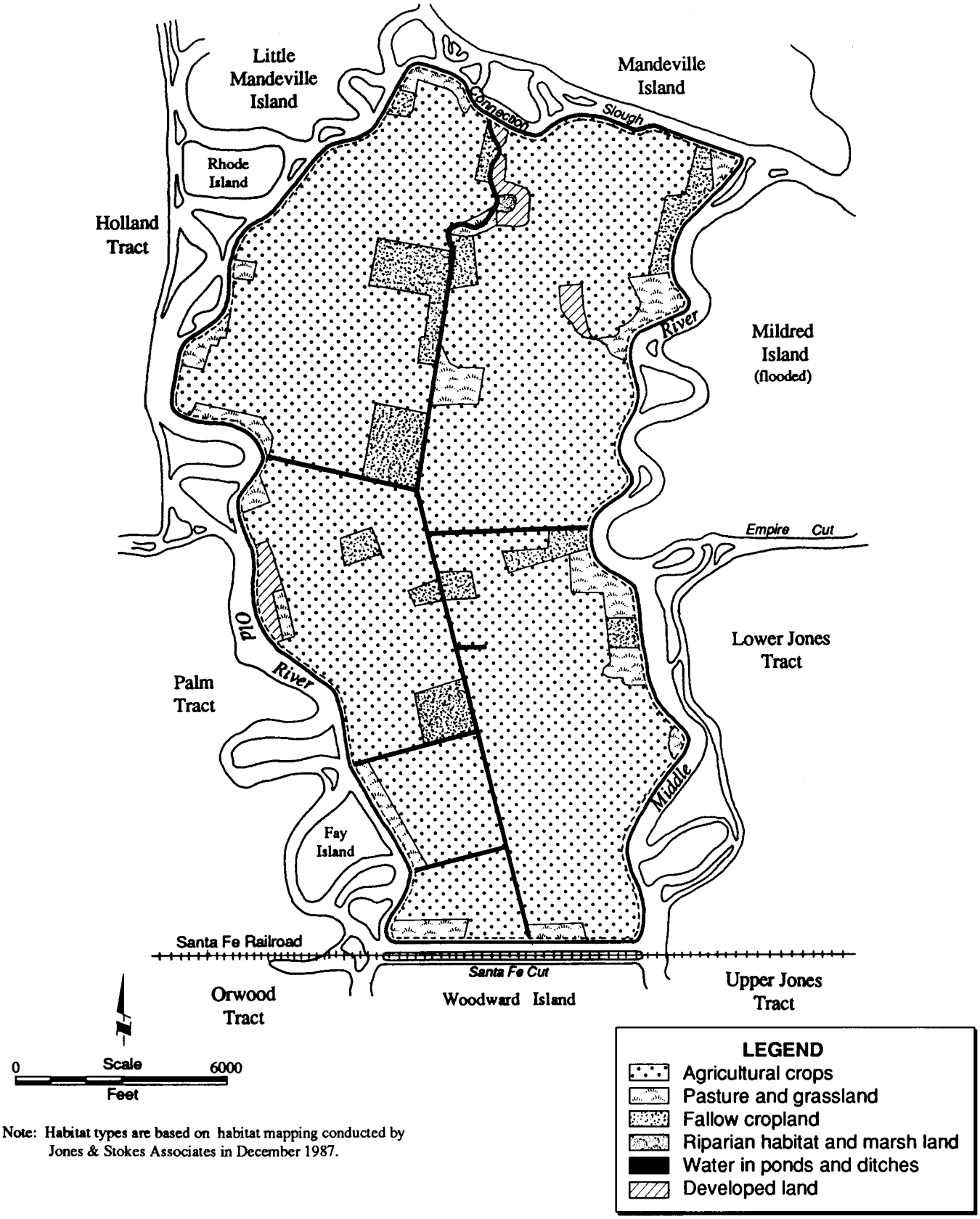
Figure 3G-3
Special-Status Plant Populations on Bouldin Island



Source: Dains 1988.

Jones & Stokes

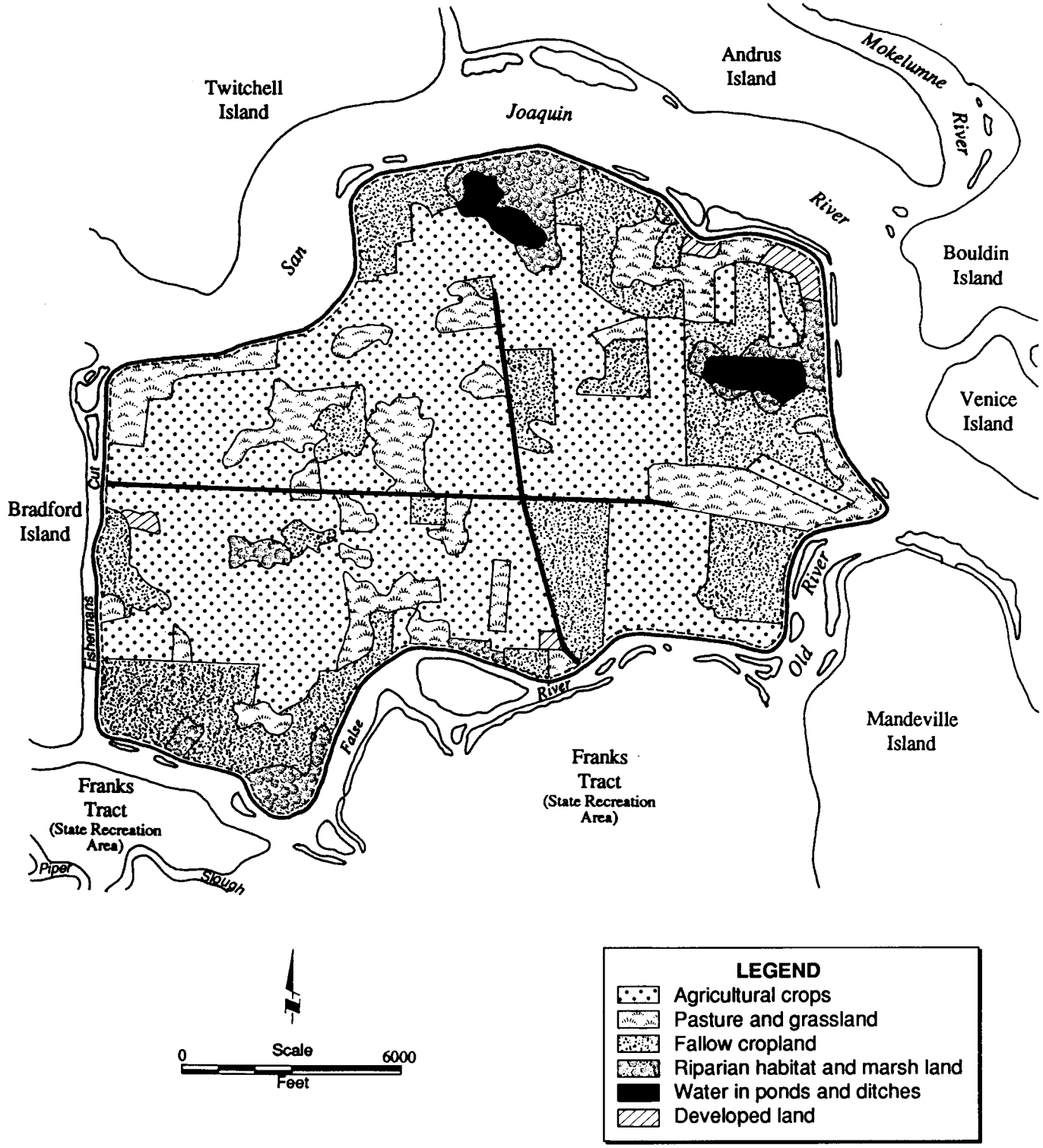
Figure 3G-4
Special-Status Plant Populations on Holland Tract



Note: Habitat types are based on habitat mapping conducted by Jones & Stokes Associates in December 1987.

Jones & Stokes

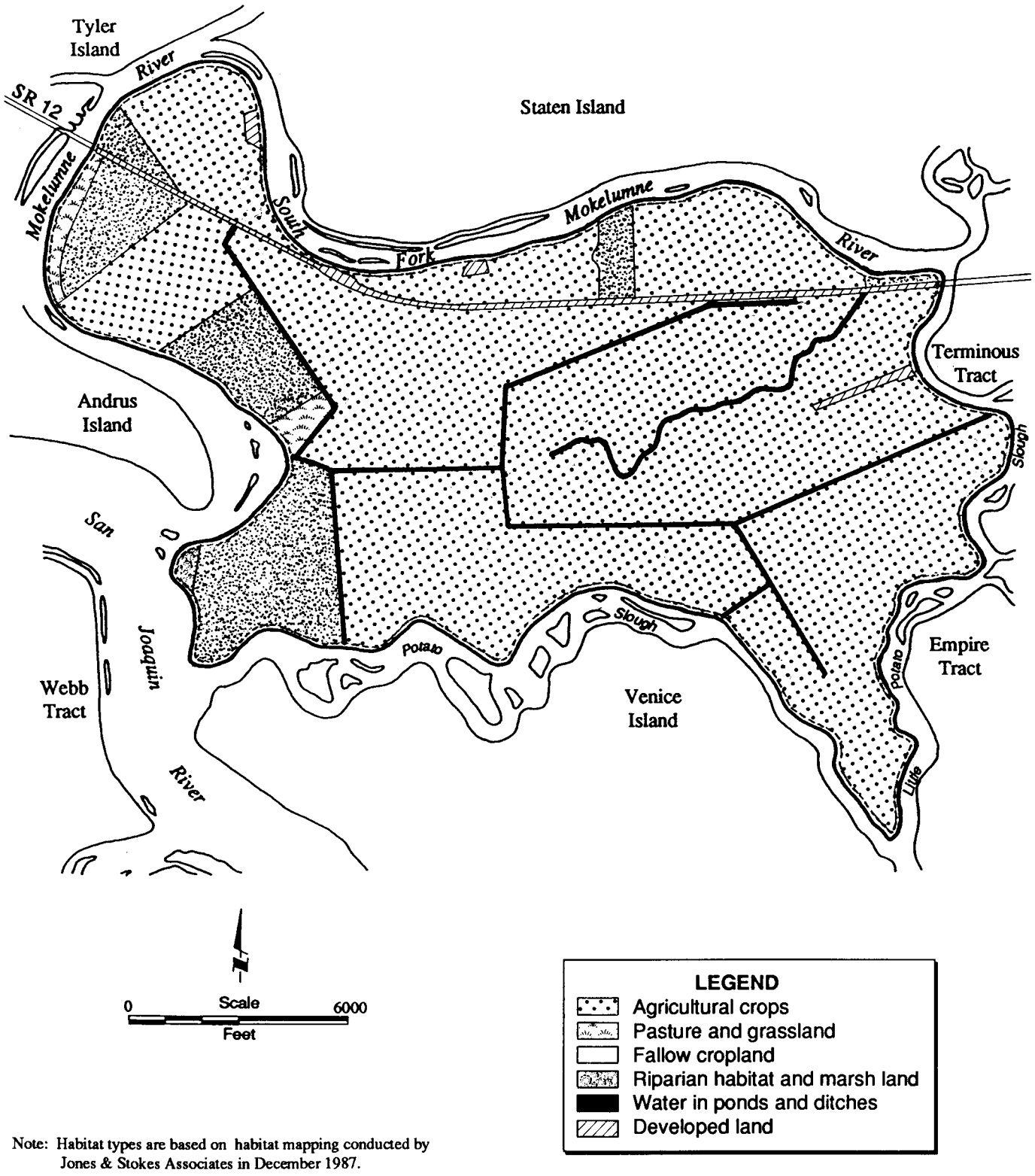
Figure 3G-5
Existing Bacon Island Habitat Types



Note: Habitat types are based on habitat mapping conducted by Jones & Stokes Associates in December 1987.

Jones & Stokes

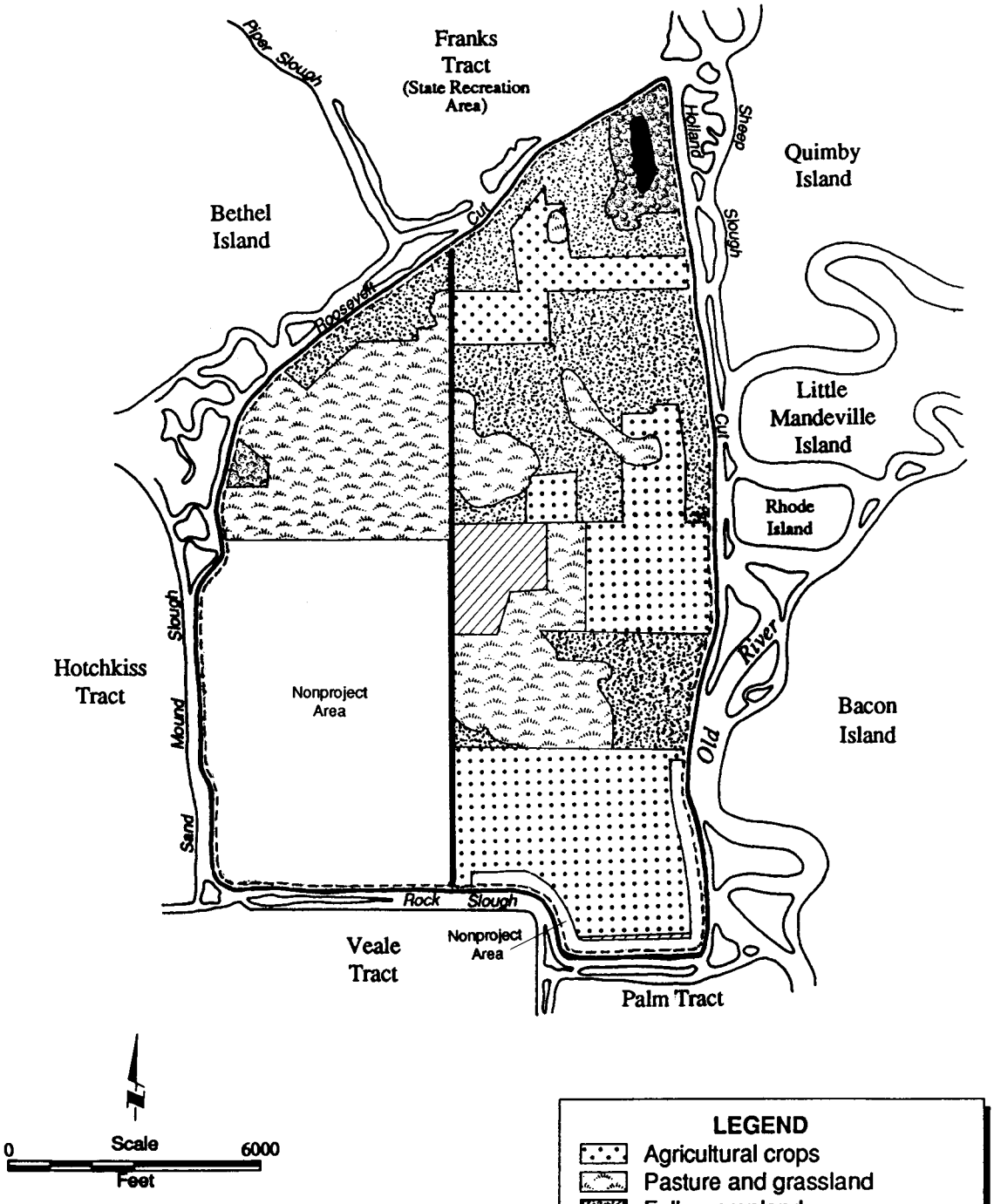
Figure 3G-6
Existing Webb Tract Habitat Types



Note: Habitat types are based on habitat mapping conducted by Jones & Stokes Associates in December 1987.

Jones & Stokes

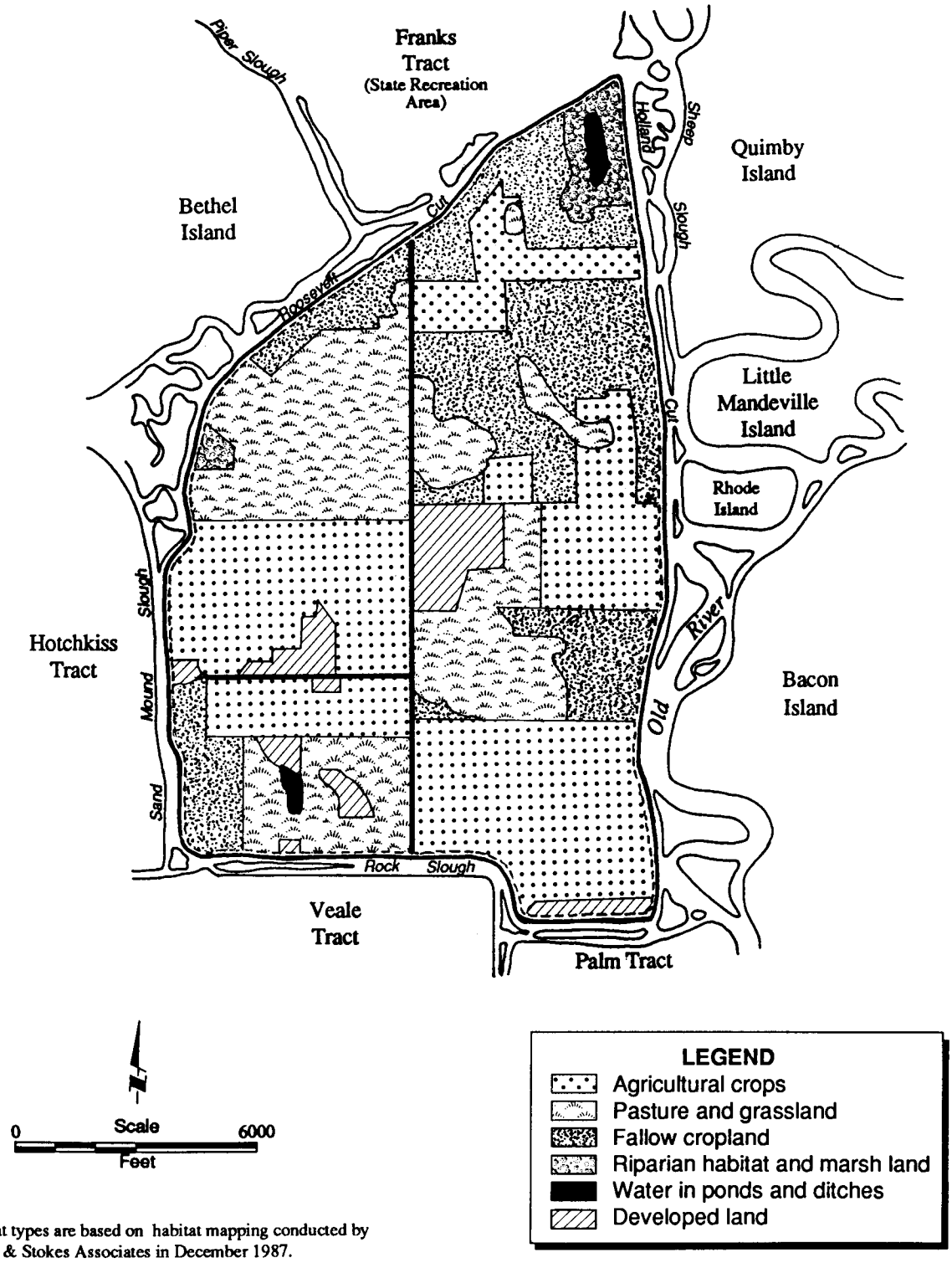
Figure 3G-7
Existing Bouldin Island Habitat Types



Note: Habitat types are based on habitat mapping conducted by Jones & Stokes Associates in December 1987.

Jones & Stokes

Figure 3G-8
Existing Holland Tract Habitat Types in the Project Area for Alternatives 1 and 2



Note: Habitat types are based on habitat mapping conducted by Jones & Stokes Associates in December 1987.

Jones & Stokes

Figure 3G-9
Existing Holland Tract Habitat Types in the Project Area for Alternative 3 and the No-Project Alternative