

**Appendix C. California Department of Fish and Game  
Biological Opinion**

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*Revised*

**California Endangered Species Act**

**Biological Opinion**

**Delta Wetlands Project**

[2090-1995-085-2]

August 6, 1998

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*Revised*  
**CALIFORNIA ENDANGERED SPECIES ACT**  
**BIOLOGICAL OPINION**  
issued by  
**THE CALIFORNIA DEPARTMENT OF FISH AND GAME**  
for  
**THE DELTA WETLANDS PROJECT**

**I. SUMMARY**

Pursuant to Fish & Game Code §2090 of the California Endangered Species Act, Fish & Game Code §2050, et seq. ("CESA"), the State Water Resources Control Board ("Board") has requested a consultation with the Department of Fish and Game ("DFG") to determine whether the Delta Wetlands Project ("Project") and the Board's issuance of a Water Right permit to Delta Wetlands will jeopardize the continued existence of any species protected under CESA or will result in the destruction or adverse modification of habitat essential to the continued existence of any such species.

DFG has determined that the State endangered winter-run chinook salmon (*Oncorhynchus tshawytscha*), State threatened delta smelt (*Hypomesus transpacificus*), State threatened Swainson's hawk (*Buteo swainsoni*), State threatened greater sandhill crane (*Grus canadensis tabida*), State endangered western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), State threatened willow flycatcher (*Empidonax traillii*), State threatened giant garter snake (*Thamnophis couchii gigas*), State threatened California black rail (*Laterallus jamaicensis coturniculus*), State endangered bald eagle (*Haliaeetus leucocephalus*), State endangered riparian brush rabbit (*Sylvilagus bachmani riparius*), State endangered American peregrine falcon (*Falco peregrinus anatum*), and State rare Mason's lilaeopsis (*Lilaeopsis masonii*) (the "Listed Species") exist at or in the vicinity of Delta Wetlands' proposed project, located in Contra Costa and San Joaquin counties.

The following additional candidate and special status species; State candidate threatened spring-run chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*), splittail (*Pogonichthys macrolepidotus*), longfin smelt (*Spirinchus thaleichthys*), Sacramento perch (*Archoplites interruptus*), green sturgeon (*Acipenser medirostris*), northwestern pond turtle (*Clemmys marmorata marmorata*), southwestern pond turtle (*Clemmys marmorata pallida*), Aleutian Canada goose (*Branta canadensis leucopareia*), tricolored blackbird (*Agelaius tricolor*), loggerhead shrike (*Lanius ludovicianus*), burrowing owl (*Athene cunicularia*), riparian woodrat (*Neotoma fuscipes riparia*), rose mallow (*Hibiscus lasiocarpus*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), and Suisun aster (*Aster lentus*) are also known to exist at or in the vicinity of Delta Wetlands' proposed project, located in Contra Costa and San Joaquin counties. A diverse assemblage of special status species are also known to exist in the

potential service areas of the proposed Delta Wetlands Project.

This Biological Opinion presents findings for the Listed Species only. Descriptions of life histories and preliminary evaluations of impacts to other species listed above, such as spring-run chinook salmon, are also included. If and when the spring-run chinook salmon is listed by the Fish and Game Commission this information will facilitate an expedited consultation when it is requested.

## II. DEFINITIONS

The following definitions shall govern interpretation of this Biological Opinion:

*"Wildlife"* means all wild animals, birds, plants, fish, amphibians, and related ecological communities, including the habitat upon which the wildlife depends for its continued viability, as provided in Fish & Game Code §711.2.

*"Take"* means to hunt, pursue, catch, capture, or kill an individual of a listed species, or to attempt any such act, as set forth in Fish & Game Code §86. The term *"kill"*, as used in Fish & Game Code §86, includes any act that is the proximate cause of the death of an individual of a species or any act a natural, probable, and foreseeable consequence of which is the death of any individual of a species.

*"Management measure"* means any action deemed necessary by the DFG to sustain a species within a natural ecological system. *"Management measures"* include legal, biological, and administrative measures.

*"Habitat Management Lands"* means those lands located on Bouldin Island and Holland Tract as well as lands acquired, restored, and managed as aquatic habitat in the estuary.

*"Project Lands"* means those lands located on Bacon Island and Webb Tract.

*"Adjusted for Inflation"* means that whenever funds are to be provided to the DFG by Delta Wetlands pursuant to this CESA Biological Opinion they will be referenced as January 1998 dollars and will be adjusted using cost indices published in the U.S. Bureau of Reclamation's "Water Systems Operations and Maintenance Cost Trends" or, in the event that index is no longer calculated, another cost indexing approach mutually acceptable to the DFG and Delta Wetlands.

*"Shallow Shoal Habitat"* means tidally influenced aquatic habitat, vegetated or not, that is < 3 meters in depth at Mean High Water.

### III. STATE AGENCY CONSULTATION PURSUANT TO ARTICLE 4 OF CESA.

CESA establishes a state policy to conserve, protect, restore, and enhance endangered species and threatened species and their habitat (Fish & Game Code, §2052). State agencies are mandated to conserve endangered and threatened species and utilize their authority to advance CESA's purposes (Fish & Game Code §2055). In addition, State agencies are charged not to approve projects that would jeopardize the continued existence of any endangered or threatened species or harm habitat essential to the continued existence of those species, if there are reasonable project alternatives that would conserve the species or the species' habitat and would prevent jeopardy (Fish & Game Code §2053).

To effectuate this policy, CESA requires State agencies that are lead agencies pursuant to the California Environmental Quality Act, Public Resources Code §21000, et seq. ("CEQA"), to consult with the DFG "to ensure that any action authorized, funded, or carried out by the state lead agency is not likely to jeopardize the continued existence of any endangered or threatened species" (Fish & Game Code §2090(a)). Whenever it consults with a CEQA State lead agency, the DFG is required to issue a written finding, based on the best available scientific information, of its determination of whether the State agency's proposed project "would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of the species" (Fish & Game Code §2090(b)). The DFG's written finding must also include the DFG's determination of whether the agency's proposed project "would result in the taking of an endangered species or a threatened species incidental to the proposed project" (Fish & Game Code §2090(c)).

If the DFG determines in its written finding that the State agency's proposed project would result in jeopardy, the DFG must "determine and specify to the state lead agency reasonable and prudent alternatives consistent with conserving the species which would prevent jeopardy to the continued existence of the species or the destruction or adverse modification of the habitat essential to the continued existence of the species" (Fish & Game Code §2091). Similarly, if the DFG determines that the State agency's proposed project would result in a taking, the DFG must "determine and specify to the state lead agency reasonable and prudent measures that are necessary and appropriate to minimize the adverse impacts of incidental taking" (*id.*).

If the State agency's project is carried out in compliance with the alternatives and measures that the DFG specifies, any take that is incidental to the project is not prohibited by CESA (*id.*). Take of threatened or endangered species that is not in compliance with the DFG's alternatives and measures is prohibited by Fish & Game Code §2080.

If the DFG determines that the State agency's proposed project would result in jeopardy, the State agency must implement the alternatives specified by the DFG to prevent jeopardy, except in limited circumstances (Fish & Game Code §2092(a) & (b)).

Where a project may affect species listed under the federal Endangered Species Act (16 U.S.C. §1531 et seq.) ("ESA") as well as CESA, CESA requires the DFG to participate to the greatest extent practicable in the federal ESA consultation for the project (Fish & Game Code §2095). CESA encourages cooperative and simultaneous consultation between State and federal agencies for such projects, such that a coordinated federal biological opinion may be developed that reflects consistent and compatible findings between State and federal agencies (id.). If possible, and if consistent with CESA, the DFG must adopt a federal biological opinion as its written findings with respect to State lead agencies (id.), unless species that are affected by the project are State listed only.

In the event Article 4 of the CESA expires on January 1, 1999, this Biological Opinion and the Reasonable and Prudent Measures contained herein will satisfy the requirements for the issuance of incidental take authorization pursuant to Article 3, Section 2081 of the CESA.

#### IV. PROJECT DESCRIPTION

The Project is the subject of federal biological opinions issued pursuant to Federal Endangered Species Act, Section 7 consultations between the United States Army Corps of Engineers ("Corps") and the United States Fish and Wildlife Service ("USFWS") and National Marine Fisheries Service ("NMFS"). The federal biological opinions are attached as Attachment 1. The Project, as it is described in the federal biological opinions and described in Attachment 2, together with the Reasonable and Prudent Measures prescribed in the federal biological opinions, and the Terrestrial Resources Habitat Management Plan (Attachment 3), along with the water budget for the Habitat Management Lands as displayed for "DW Project Islands Wildlife Habitat Use" in Table A1-8 of Appendix A of the Project's DEIR/EIS (contained in Attachment 6) are adopted by the DFG as the "Project" for purposes of this biological opinion.

This CESA Biological Opinion applies only to the project described and does not assess the project as being coordinated with the State-Water Project (SWP) or Central Valley Project (CVP) or managed as a component of the SWP or CVP. This CESA Biological Opinion specifically does not address reoperations of SWP or CVP facilities. The reoperation of the Project in coordination with the SWP or CVP may require a new consultation pursuant to Section 2090 or 2081. If the Project is sold all measures and operational criteria shall apply to the new owner. To the extent that the new owner seeks to change operations so that operations are coordinated with the SWP or CVP, reconsultation may be necessary and, if the DFG deems it necessary, a revised CESA Biological Opinion will be issued. In addition, if any component of the Project, such as the HMP or the operation of the habitat islands and the associated water budget for the Habitat Management Lands, deviates from the current project description as set forth in the DEIR/EIS, and the deviation results in a significant additional adverse impact and a significant degradation of Reasonable and Prudent Measure 2.0 set forth in this Biological Opinion to minimize the adverse impacts of take of winter-run and delta smelt, this shall represent a significant project modification and formal consultation shall be

reinitiated pursuant to Section 2090 or in its absence, 2081. However, DFG recognizes that June diversions onto the habitat islands shown in Table A1-8 (Attachment 6) could be reduced below the level shown and acknowledges that a significant reduction in June diversions would not constitute a significant project modification.

## V. LISTED SPECIES

Listed and special status species in the Project area are included in Table 1. The summary of life history information for the Listed Species contained in the federal biological opinions is hereby adopted by the DFG for purposes of this Biological Opinion and supplemented by the life history information contained in Attachment 4. A summary life history of the other State Listed Species is included in Attachment 4.

## VI. EFFECTS ON LISTED SPECIES

The DFG evaluated the proposed action for its likelihood to affect those species listed in Table 1. A number of species are found within or immediately adjacent to the Estuary but will not be affected, either directly or indirectly, by the Project. Those species will not be discussed further in this Biological Opinion. The species remaining include those that may be adversely affected by the proposed project or those that are not currently present on the project islands but which may begin to use either the Habitat Management Lands or Project Lands following project implementation. Those species will be discussed and the impacts of the proposed action described.

### A. PROJECT IMPACTS OVERVIEW

The Project may subject the Listed Species to both direct and indirect adverse impacts, and temporary and permanent impacts, including the take of individuals of the Listed Species. The Project will result in temporary and permanent impacts to 21,000 acres of potential habitat for the terrestrial Listed Species. Listed Species displaced by the Project may escape direct injury, but will have to compete for food and living space in adjacent areas. Relocated individuals will be more vulnerable to disease, predation, and accidental death. Disturbance of the existing habitat will temporarily reduce the prey base and/or foraging area for individuals residing in the Project vicinity.

The Project's impacts on its potential service areas could result in land use changes that adversely affect the habitats of special status species (Appendix A of Attachment 4).

Other impacts include temporary impacts to terrestrial habitats associated with the required routine operation and maintenance of the Habitat Management Lands and Project Lands as provided for in the Habitat Management Plan (HMP). Impacts include, but are not limited to, discing, excavating supply and drainage ditches, and selective herbicide applications.

Table 1. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Listed Species and Special Status Species.

<u>Species</u>	<u>Status</u>
<u>Fish</u>	
Splittail ( <i>Pogonichthys macrolepidonus</i> )	FPT
Winter-run chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	FE,SE
Spring-run chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	SCT
Steelhead ( <i>Oncorhynchus mykiss</i> )	FT
Delta smelt ( <i>Hypomesus transpacificus</i> )	FT,ST
Longfin smelt ( <i>Spirinchus thaleichthys</i> )	1/
Sacramento perch ( <i>Archoplites interruptus</i> )	1/
Tidewater goby ( <i>Eucyclogobius newberryi</i> )	FE
Green sturgeon ( <i>Acipenser medirostris</i> )	1/
<u>Amphibians</u>	
California red-legged frog ( <i>Rana aurora draytonii</i> )	FT
California tiger salamander ( <i>Ambystoma californiense</i> )	1/
Western spadefoot toad ( <i>Scaphiophus hammondi</i> )	1/
<u>Reptiles</u>	
Giant garter snake ( <i>Thamnophis couchii gigas</i> )	FT,ST
Northwestern pond turtle ( <i>Clemmys marmorata marmorata</i> )	1/
Southwestern pond turtle ( <i>Clemmys marmorata pallida</i> )	1/
San Francisco garter snake ( <i>T. sirtalis tetrataenia</i> )	SE,FE
<u>Birds</u>	
California brown pelican ( <i>Pelecanus occidentalis californicus</i> )	FE,SE
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	FE,SE
American peregrine falcon ( <i>Falco peregrinus anatum</i> )	FE,SE
Aleutian Canada goose ( <i>Branta canadensis leucopareia</i> )	FT
California black rail ( <i>Laterallus jamaicensis coturniculus</i> )	1/,ST
Western snowy plover ( <i>Charadrius alexandrinus nivosus</i> )	FT
California clapper rail ( <i>Rallus longirostris obsolenus</i> )	FE,SE
California least tern ( <i>Sterna antillarum browni</i> )	FE,SE
Tricolored blackbird ( <i>Agelaius tricolor</i> )	1/
Saltmarsh common yellow throat ( <i>Geothlypis trichas sinuosa</i> )	1/
Suisun song sparrow ( <i>Melospiza melodia maxillaris</i> )	1/
San Pablo song sparrow ( <i>Melospiza melodia samuelis</i> )	1/
Swainson's hawk ( <i>Buteo swainsoni</i> )	ST
Greater sandhill crane ( <i>Grus canadensis tabida</i> )	ST
Bank swallow ( <i>Riparia riparia</i> )	ST
Western yellowbilled cuckoo ( <i>Coccyzus americanus occidentalis</i> )	SE,1/
Loggerhead shrike ( <i>Lanius ludovicianus</i> )	1/
Burrowing Owl ( <i>Athene cunicularia</i> )	SSC

Mammals

Suisun ornate shrew ( <i>Sorex ornatus sinuosus</i> )	1/
Salt marsh harvest mouse ( <i>Reithrodontomys raviventris</i> )	FE,SE
Yuma myotis/bat ( <i>Myotis yumanensis</i> )	1/
Riparian woodrat ( <i>Neotoma fuscipes riparia</i> )	1/
Riparian brush rabbit ( <i>Sylvilagus bachmani riparius</i> )	SE
San Joaquin kit fox ( <i>Vulpes macrotis mutica</i> )	ST,FE
Salt marsh wandering shrew ( <i>Sorex vagrans halicoetes</i> )	1/

Plants

Rose mallow ( <i>Hibiscus lasiocarpus</i> )	1/
Delta tule pea ( <i>Lathyrus jepsonii</i> var. <i>jepsonii</i> )	1/
Suisun slough thistle ( <i>Cirsium hydrophilum</i> var. <i>hydrophilum</i> )	FE
Suisun aster ( <i>Aster lentus</i> )	1/
Mason's lilaeopsis ( <i>Lilaeopsis masonii</i> )	1/,SR
Soft bird's beak ( <i>Cordylanthus mollis</i> ssp. <i>mollis</i> )	FE,SR
Hispid bird's beak ( <i>Cordylanthus mollis</i> ssp. <i>hispidus</i> )	1/
Delta button-celery ( <i>Eryngium racemosum</i> )	SE,1/
Salt marsh bird's beak ( <i>Cordylanthus maritimus</i> ssp. <i>maritimus</i> )	SE,FE
Contra Costa wallflower ( <i>Erysimum capitatum</i> ssp. <i>angustatum</i> )	SE,FE
Antioch Dunes evening-primrose ( <i>Oenothera deltoides</i> ssp. <i>howellii</i> )	SE,FE
Pitkin Marsh Indian paintbrush ( <i>Castilleja uliginosa</i> )	SE,1/
Slough thistle ( <i>Cirsium crassicaule</i> )	1/
San Joaquin saltbush ( <i>Atriplex joaquiniana</i> )	1/
California beaked-rush ( <i>Rhynchospora californica</i> )	1/
Contra Costa goldfields ( <i>Lasthenia conjugens</i> )	1/
Heart Scale ( <i>Atriplex cordulata</i> )	1/
Tiburon Indian paint brush ( <i>Castilleja affinis neglecta</i> )	1/
Contra Costa buckwheat ( <i>Eriogonum truncatum</i> )	1/
Legenere ( <i>Legenere limosa</i> )	1/
Northern California black-walnut ( <i>Juglans californica</i> var. <i>hinksii</i> )	1/
Sanford's arrowhead ( <i>Sagittaria sanfordii</i> )	1/
Gardner's yampah ( <i>Perideridia gairdneri</i> ssp. <i>gairdneri</i> )	1/
Fountain thistle ( <i>Cirsium fontinale</i> var. <i>fontinale</i> )	SE,1/
Burke's goldfields ( <i>Lasthania burkei</i> )	SE,1/
Mt. Hamilton thistle ( <i>Cirsium fontinale</i> var. <i>campylon</i> )	1/
San Francisco gumplant ( <i>Grindelia maritima</i> )	1/
Hairless popcorn flower ( <i>Plagiobothrys glaber</i> )	1/
Bearded popcorn flower ( <i>Plagiobothrys hystriculus</i> )	1/
Calistoga popcorn flower ( <i>Plagiobothrys strictus</i> )	1/
Swamp sandwort ( <i>Arenaria paludicola</i> )	1/
Showy indian clover ( <i>Trifolium amoenum</i> )	1/
Sepastopol meadowfoam ( <i>Linumnanthes vincularis</i> )	SE,1/
Kenwood marsh checkerbloom ( <i>Sidalcea oregana</i> ssp. <i>valida</i> )	SE,1/
Marin knotweed ( <i>Polygonum marinense</i> )	1/
Palmate-bracted bird's-beak ( <i>Cordylanthus palmatus</i> )	FE
White sedge ( <i>Carex alhida</i> )	SE,1/
Pitkin marsh lily ( <i>Lilium pardalinum</i> ssp. <i>pitkinense</i> )	SE,1/
Napa bluegrass ( <i>Poa napensis</i> )	SE,1/

Insects

Lange's metalmark butterfly (*Apodemia mormo langei*) FE  
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) FT  
Sacramento anthicid beetle (*Anthicus sacramento*) 1/  
Delta green ground beetle (*Elaphrus viridis*) FT

Other Invertebrates

Longhorn fairy shrimp (*Branchinecta longiantenna*) FE  
California freshwater shrimp (*Syncaris pacifica*) SE, FE  
Conservancy fairy shrimp (*Branchinecta conservatio*) FE  
Vernal pool fairy shrimp (*Branchinecta lynchi*) FT  
California linderiella (*Linderiella occidentalis*) FPE  
Vernal pool tadpole shrimp (*Lepidurus packardii*) FE

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FE = Federal Endangered                      1/ = Former Federal Candidate continues to be species of concern  
FT = Federal Threatened                      ST = State Threatened  
FPT = Federal proposed Threatened        SE = State Endangered  
FPE = Federal proposed Endangered        SSC = Species of Special Concern        SR = State Rare  
SCT = State Candidate Threatened

The Delta Wetlands Project will also result in impacts to the aquatic Listed Species including:

1. Direct entrainment of delta smelt larvae onto the Project Lands due to additional, new diversions of up to 9,000 cfs.
2. Increased entrainment of delta smelt larvae, juveniles, and adults into other south Delta diversions and increased mortality due to new diversions in the central and south Delta and increased exports associated with the discharge and export of Delta Wetlands Project water at the State and Federal export facilities.
3. Increased loss of juvenile winter-run and spring-run chinook salmon from adverse modifications to internal Delta channel hydraulics which can increase the diversion of fish into the western, central, and south Delta where they are exposed to increased entrainment into other south Delta diversions including the State and Federal export facilities and increased mortality from other factors such as predation.
4. Increased erosion of in-channel habitat for delta smelt and winter-run chinook salmon associated with increased boating activity facilitated by the Project.
5. Degradation of spawning and rearing habitat for delta smelt and splittail due to construction.
6. Increased losses of adult and juvenile delta smelt and juvenile winter-run and spring-run chinook salmon due to increased predation losses associated with fish screen structures, siphon and pump stations, and boat docks.
7. Temperature-related mortality of winter-run and spring-run chinook salmon and delta smelt from elevated temperatures caused by the discharge of water.
8. Impacts to aquatic Listed Species habitat from decreased dissolved oxygen (DO) levels caused by the discharge of water from the reservoir islands.
9. Reduced Delta Outflow and loss of associated biological benefits due to increased project diversions onto the reservoir islands.
10. Upstream shifts of X2 due to increased project diversions onto the reservoir islands.
11. Reductions in QWEST due to increased project diversions onto the reservoir islands.

12. Other adverse Delta channel hydraulics that impact the nutrient cycling, rearing, food web support, and transport functions of the Delta and the Delta's ability to provide a healthy nursery and migratory habitat that supports the continued existence of the delta smelt and winter-run and spring-run chinook salmon.

### 1. WILDLIFE IMPACTS

Using 1987 aerial photographs along with cropping data, the habitat and crop types, and their areal extent were calculated by Jones and Stokes Associates (JSA) for both the habitat islands as well as the reservoir islands. Based on those data the acreage of suitable habitat for the greater sandhill crane and Swainson's hawk was determined. The proposed project will impact 7,028 acres of suitable sandhill crane habitat and 10,048 acres of suitable Swainson's hawk habitat.

No immediate effect is expected on the other terrestrial Listed Species such as the yellow-billed cuckoo, giant garter snake, western pond turtle, or black rail. Once the habitat islands are functioning, suitable habitat will likely be restored and benefit these species. However, once established they may become vulnerable to routine management and maintenance activities.

### 2. PLANT IMPACTS

Special status plants such as Mason's lilaepsis, rose mallow, and Delta tule pea are found in the project area. Direct impacts on these species due to project implementation is expected to be minor.

### 3. FISH IMPACTS

This evaluation describes the effects of Delta Wetlands Project operation on winter-run, spring-run, and delta smelt as it would be allowed to operate by the federal biological opinions.

The Delta Wetlands Project, as allowed by the federal biological opinions:

- Would result in increases in take of delta smelt, winter-run, and spring-run at key times for all three species:
  - Adult delta smelt begin their upstream movement into Delta spawning areas in January through March; delta smelt larvae and juveniles in February through July; winter-run juveniles in January through March; spring-run yearlings in October through March; young-of-the-year spring-run juveniles in March through June.

- Would increase take of delta smelt, winter-run, and spring-run due to the exacerbation of adverse hydraulic conditions in the Delta by:
  - Increasing reverse flows toward the central and south Delta; reducing Delta Outflow; decreasing QWEST; and, allowing unmodified project operations during conditions of low San Joaquin River flows in the late winter and early spring. Through reduced Delta outflow and reduction in net westerly flow, Project operation is expected to degrade conditions for proper smolt outmigration stimulus and seaward orientation, and generally reduce smolt survival.
- Would result in increased entrainment of juvenile winter-run and spring-run chinook salmon into the interior Delta and reduce their survival rates. Lower survival rates are expected due to the longer migration route where fish are exposed to increased predation, higher water temperatures, unscreened agricultural diversion, poor water quality, reduced availability of food, and entrainment at the CVP/SWP export facilities.
- Would result in adverse changes in Delta hydrodynamics during the period when adult delta smelt are migrating upstream into the Delta and during portions of the critical spawning and rearing period for larval and juvenile delta smelt are expected to result in increased losses of adult, larval, and juvenile delta smelt. Lower survival rates are expected due to conditions where delta smelt are exposed to increased entrainment at the CVP/SWP facilities. Reduced outflow, decreases in net westerly flow, and shifts in the position of X2 are expected to degrade delta smelt spawning and rearing habitat in the Bay-Delta, degrade conditions for natural transport flows westward, and generally reduce delta smelt survival.
- Would not reduce take under most conditions because the Project does not include a mechanism for improving hydraulic conditions for delta smelt and winter-run at other times through the release of "environmental water" that can be used to offset those unavoidable losses.
- Could result in increased take due to deficient water quality protection, particularly for winter-run and spring-run chinook salmon. Could allow discharge water to degrade receiving water temperatures by up to 4° F when receiving water temperatures are between 58° and 66° F. This level of increase, when winter-run chinook salmon are present, could cause a significant increase in the levels of chronic stress and result in increased mortality as a result of impaired smoltification, reduced ability to complete osmoregulatory adaptations, increased risk of disease, and increased predation.

Unless modified, the Project will continue to cause significant, unmitigated adverse

impacts to delta smelt, winter-run, and spring-run. Hydrodynamic changes associated with the Project will degrade important ecosystem functions that support nutrient cycling, spawning, rearing, migration, and larval transport in the Delta. Impairment of those functions has degraded the ecological health of the Delta and contributed to the listing of delta smelt and winter-run chinook salmon and the candidacy of the spring-run chinook salmon. The Project will result in reduced survival of delta smelt, winter-run, and spring-run chinook salmon.

## B. METHODS

The DFG used a broad assortment of analytical tools and approaches to conduct its evaluation of the proposed project and to ultimately develop its Reasonable and Prudent Measures. The principle approach used by the DFG was to assess how aquatic habitat conditions would be affected by Delta Wetlands project operations. Aquatic habitat variables and project operation impacts included Delta channel hydraulics, QWEST, Delta outflow, project diversions, discharges for export, and water quality. The DFG also assessed the extent of entrainment into diversions of larval delta smelt. Most of the analytical tools and data have been provided by JSA on behalf of the Board and U.S. Army Corps of Engineers. While much of it was contained in the Biological Assessment dated June 21, 1995, JSA has supplemented it with information such as more detailed entrainment data, alternative strategies for estimating the percent of out-migrating winter-run present in the Delta in any given month, and data on the results of modeling alternative operation approaches to that originally proposed in the Biological Assessment. The DFG used data output provided by JSA and life history data assembled from the Biological Assessment and contacts with agency species experts.

The results of JSA's computer model analyses were provided to the DFG in writing in a March 25, 1997 memorandum and electronically in April 1997. Those analyses compared the no-project alternative, the updated project operated using the January 27, 1997 Operations Criteria as allowed by the federal biological opinions, and the updated project with additional operating criteria proposed by the DFG. The model run data bases were used in the following assessment to evaluate impacts to listed fish.

The DFG used the operations model data to assess project impacts and develop the Reasonable and Prudent Measures in recognition that the modeled hydrologic conditions may not be repeated in the future. The DFG also used the operations model data recognizing that the model presents data in monthly time steps and that monthly averages can mask more significant changes that occur over shorter periods of time. The DFG, therefore, developed Reasonable and Prudent Measures that would be effective in avoiding or minimizing impacts regardless of future hydrologic patterns or magnitude of daily changes. Measures are described which avoid large changes in Delta hydrodynamics during critical periods for listed species. This approach will help support important ecological functions including providing proper flow cues for migrating adult and juvenile winter-run and spring-run chinook salmon

and suitable transport flows for delta smelt.

## 1. MODELING TOOLS

The DFG used the results of three modeling tools, DWRSIM, Delta Standards and Operations Simulation (DeltaSOS), and DeltaMOVE as part of its overall approach to evaluating the impacts of the Delta Wetlands project on listed fish.

**DWRSIM-** The results of DWRSIM 1995-C6B-SWRCB-409, performed in January 1995, were provided to the Board for use by JSA as the initial Delta water budget in the DeltaSOS simulations to evaluate proposed Delta Wetlands Project impacts.

**DeltaSOS-** The simulations used to estimate Delta Wetlands Project effects were performed with the DeltaSOS model. The primary assumptions used in the DeltaSOS are that the 1995 Water Quality Control Plan (WQCP) objectives will be satisfied, and that all in-Delta diversions and allowable CVP/SWP exports will be made prior to any Delta Wetlands diversions for storage. The Delta Wetlands diversions are limited by the available water within the 1995 WQCP objectives with maximum CVP/SWP exports assumed. Since the DeltaSOS is a monthly model, it may underestimate the magnitude of project induced changes. Appendix A4 of the draft EIR/EIS, for instance, concludes that simulated daily operations of the Delta Wetlands Project and subsequent impacts on listed fish would likely be greater than simulated with the monthly model.

**DeltaMOVE-** DeltaMOVE is the other basic tool used to evaluate project impacts and to develop operational criteria for the Delta Wetlands Project. Delta Wetlands Project operations could affect delta smelt survival and abundance by affecting transport flows. After hatching, larvae require net flow movement for transport to downstream optimal low-salinity habitat. DeltaMOVE was used to simulate transport of delta smelt to downstream habitat following hatching in the Delta. The estimated percentage of the spawned population that is entrained provides an indicator of losses during transport to downstream optimal low-salinity habitat. This indicator was used to describe related project impacts. Impacts to winter-run were assessed by using DeltaMOVE data for the northern portion of the Delta only.

The entrainment index for Delta conditions with the Delta Wetlands Project indicates the direction and magnitude of potential change in entrainment loss relative to conditions simulated for the No-Project Alternative. The entrainment index should not be construed as the actual level of entrainment that would occur. Simulated monthly conditions, fixed spawning distribution, and assumed transport characteristics of a life stage cannot accurately characterize the complex conditions and variable time periods that affect entrainment during occurrence of planktonic life stages or occurrence of rearing juveniles in the Delta.

JSA used the entrainment index for one portion of the Delta to estimate changes in winter-run mortality associated with Project operations. Limitations of the mortality index, as described by the NMFS in its October 26, 1995 letter to the Corps (Attachment 6), were also carefully weighed by the DFG and resulted in a decision to depend on changes in the entrainment index values themselves to assess potential impacts to winter-run. Thus, data provided by DeltaMOVE yielded important information used by the DFG to assess changes in entrainment and changes in internal Delta hydrodynamics.

### **Factors Modeled and Evaluated**

The following factors were evaluated in order to evaluate the impacts of the Delta Wetlands Project for all 70 years of modeling. To depict a more accurate assessment of how the Delta Wetlands Project affects aquatic resources the DFG also evaluated data specific to only those months when the Delta Wetlands Project is predicted to operate. Based on Appendix A4 of the Draft EIR/EIS, the frequency of actual operation could be as much as 25 to 50 percent greater than modeled. Project modification described in the January 27, 1997 Final Operations Criteria, however, may have limited the magnitude of this enhanced operation.

The habitat variables that were evaluated by the DFG included changes in the X2 location (the location of the 2 ppt isohaline relative to the Golden Gate Bridge), changes in the area of suitable salinity habitat in Suisun Bay, various modeled indices which help define changes in internal Delta hydrodynamic conditions, QWEST, and net flow changes in selected Delta channels.

**North and Central Delta Flows-** An indicator of north and central Delta flow conditions was evaluated. Called the Cross Delta Flow Parameter (CDFP), it is calculated with the DeltaMOVE fish transport model discussed in "Methods for Assessing Effects on Fish Transport" and Appendix A of the Biological Assessment. The model simulates introduction of a concentration of particles into the Mokelumne River side of the Delta at the beginning of a month. The proportion of the concentration entrained in exports and other Delta diversions is the monthly CDFP.

**Other Indices-** Other indices were also used, including the lower Sacramento River and lower San Joaquin River to get a more complete picture of how fish in the Sacramento River or west Delta may be affected by project operations.

**X2 and Aquatic Habitat in Suisun Bay-** Salinity is an important habitat factor and is strongly affected by Delta outflow. The maximum and average upstream shifts in X2 were assessed by the DFG in order to calculate project induced reductions in the amount of shallow shoal and low elevation tidal rearing habitat in Suisun Bay. The area of suitable rearing habitat in Suisun Bay, based on the location of X2, was calculated for delta smelt. Figure 9 in Appendix A of the Biological Assessment was used along with data on the predicted upstream

shift in X2 to estimate changes in area of suitable rearing habitat in Suisun Bay using a planimeter.

**QWEST-** QWEST is a calculated flow parameter representing net flow between the central Delta and the western Delta (i.e., flow past Antioch other than the Three-mile Slough contribution). Although QWEST criteria are not included in the 1995 WQCP, QWEST criteria have previously been considered for protection of central Delta fish (NMFS 1993) and continues to be an important measurement tracked by the DFG for this Biological Opinion.

**Net Flows in Middle and Old Rivers-** The net flow in Middle and Old rivers is generally to the south in most months. Delta Wetlands Project operations can exacerbate that by increasing flows south and further degrading central Delta hydraulic conditions.

**Diversion Rates and Diversion Timing-** Diversion rates and diversion timing predicted by operation modeling were used extensively by the DFG to assess project impacts and identify effective avoidance measures. Modeling also provides predictions on the frequency of Delta Wetlands Project operations during the 70 years simulated. Diversions made outside of periods of species occurrence avoid direct impacts to those species. Diversion limits were used to reduce impacts on aquatic habitat and to control entrainment of fish and other aquatic organisms, including direct mortality caused by increased predation, abrasion, and impingement. Diversion rate alone, however, does not account for variability in entrainment loss caused by variable species abundance, species distribution, and species and life stage vulnerability. The DFG, therefore, considered other factors such as indices of abundance; e.g. the fall mid-water trawl (FMWT), in-channel monitoring in the vicinity of the project's intakes and discharges, and diversion restrictions during periods when vulnerability to entrainment was highest.

## 2. ENTRAINMENT DATA AND HYDRAULIC CONDITIONS

Since the largest impacts occur when project operations take place during months when the populations and life stages are the most vulnerable and when internal Delta hydrodynamics are adverse; e.g. high levels of diversions relative to Delta outflow and San Joaquin River inflow, the DFG focused on evaluating impacts and defining more favorable conditions when project operations could occur and take could be reduced. These conditions needed to be defined in a manner that minimized the likelihood that modeled monthly averages would mask daily operational influences that can result in greater impacts than the monthly data suggest. The process included several modeling iterations of alternative approaches that were inspected to assess the performance for a given set of measures. JSA performed these model analyses using the assumptions provided by the DFG for each alternative evaluated.

### 3. SPECIES LIFE HISTORY

The DFG inspected life history data from a variety of sources to identify periods of greatest vulnerability such as migration periods and the presence of more vulnerable life forms such as eggs, larvae, and juveniles. Those data combined with field sampling data were used to fine tune information on monthly distribution of winter-run chinook salmon and delta smelt in the Delta. Figure 1, for instance, displays the percent of annual production of juvenile winter-run chinook salmon in the Delta by month. Figure 2 displays important life history information for winter and spring-run chinook salmon and delta smelt.

#### a. Factors Influencing Project Impacts on Winter-Run Chinook Salmon

Attachment 4 provides the relevant information on the life history of this species used to conduct the impact analysis. It contains significant information which helps to understand the reasons for the Reasonable and Prudent Measures. It should be carefully reviewed as a step in reviewing the rationale for the Reasonable and Prudent Measures. Several important elements include the timing of upstream adult migration through the Delta and the timing of the downstream migration of juvenile winter-run chinook salmon.

**Rearing Habitat-** The Delta provides important rearing habitat for chinook salmon prior to smoltification and continued migration to the ocean. The extent of use likely varies depending on factors such as upstream hydrologic conditions. Rearing habitat is most vulnerable to impacts from the beginning of January to the end of March.

January through April are the primary months when juvenile winter-run salmon are present in the Delta based on USFWS trawl and seine data for 1992-1995. These data suggest that a portion of the chinook salmon population use the Delta as a migration corridor, remaining in the Delta approximately one month and are affected by Delta conditions only during that month. Juvenile salmon also rear in the Delta until they are ready to migrate to the ocean. Those juvenile chinook salmon are exposed to several months of Delta conditions and their vulnerability to the adverse impact of the Delta Wetlands Project increases in diversions. From year to year juvenile migration timing is affected by hydrologic conditions.

The USFWS trawl and seine data for 1992-1995 indicate that winter-run chinook salmon are affected most by increased diversions or exports during February and March. The evaluation of Delta Wetlands Project impacts on winter-run chinook salmon for the Biological Opinion took into account their occurrence in the Delta based on their distribution as depicted in Figure 1.

The monthly percentages of the annual production of juvenile winter-run chinook salmon present in the Delta used to assess the Delta Wetlands project's effects on juvenile

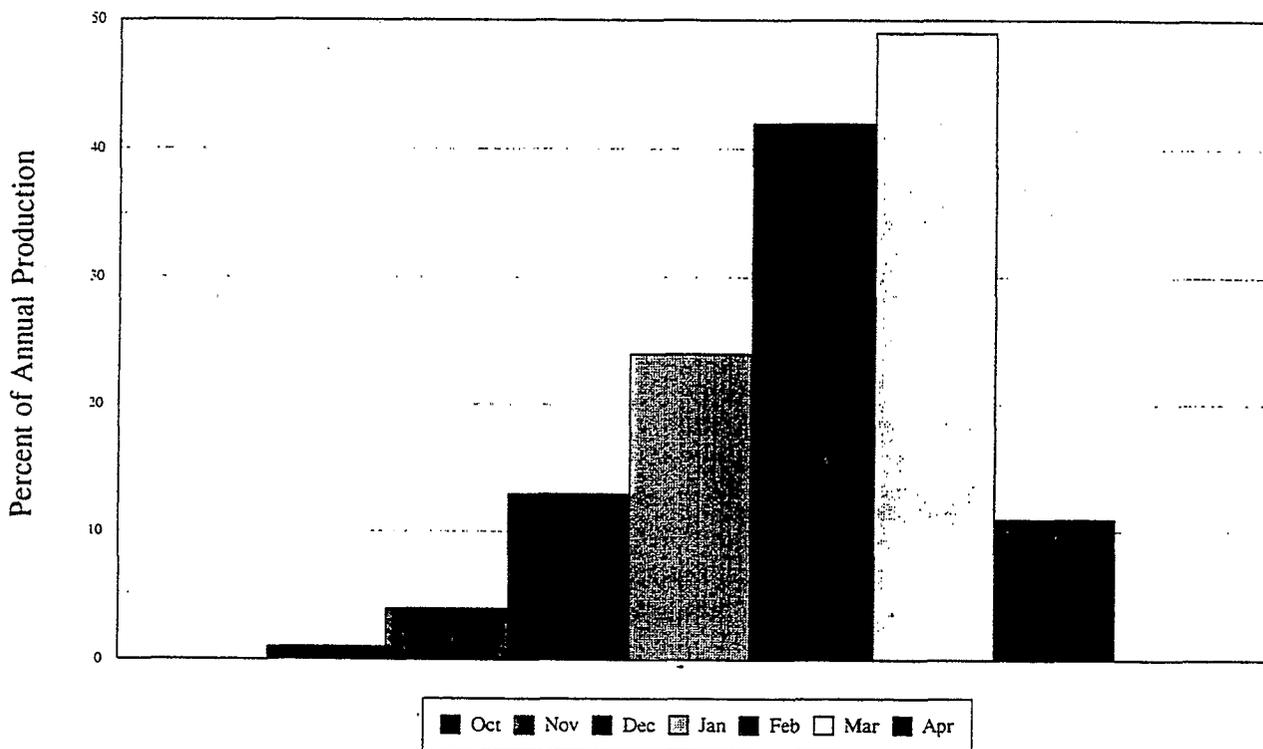


Figure 1. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Percent of Annual Production of winter-run Chinook salmon present in the Delta by month.

Winter Run

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
Adult Upstream Migration	█												█
Juvenile emigration through Delta	█									█			

Spring Run

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Adult Upstream Migration	█											
Juvenile emigration through Delta	yearling			█						yearlings		

Delta Smelt

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Adult Upstream Migration	█											█
Spawning	█											█
Larvae	█											
Juveniles		█										

Figure 2. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. In Delta life history information for winter-run and spring-run Chinook salmon and delta smelt.

winter run were: winter run were:

October	1%	February	42%
November	4%	March	49%
December	13%	April	11%
January	24%		

**Juvenile Migration-** Juvenile winter-run chinook salmon are present in the Delta in the vicinity of the Delta Wetlands Project islands between early September through May. During this period they are vulnerable to physical disturbance, entrainment, elevated water temperatures, and flow disruptions.

Increasing entrainment indices reflect a degradation of Delta hydraulic conditions and decrease survival for juvenile winter-run chinook salmon as they are drawn through the Delta Cross Channel (DCC) and Georgiana Slough and east through Three-Mile Slough and the lower San Joaquin River.

Mark-recapture experiments conducted in the Sacramento River suggest improved survival when juvenile salmon continue down the Sacramento River rather than through the DCC or Georgiana Slough. Nevertheless, the adverse habitat conditions associated with hydraulic changes in the central Delta which results in entrainment of juveniles into the central and south Delta, decreases survival for juvenile winter-run chinook salmon as they are drawn through the DCC and Georgiana Slough and east through Three-Mile Slough and the lower San Joaquin River.

**Adult Migration-** Adequate flows and suitable water quality are needed to ensure that adults can move upstream towards their spawning habitat and are not subjected to elevated water temperatures. The timing of adult migration varies from late November through June. The channels around Webb Tract and Bouldin Island are areas that adult winter-run may use during their upstream migration and where winter-run are vulnerable to physical disturbance and flow disruption during migratory periods.

#### **b. Factors Influencing Project Impacts on Spring-Run Chinook Salmon**

Attachment 4 contains significant information on this species' life history. It should be carefully reviewed as a step in understanding the basis for the DFG's conclusions regarding Project impacts on spring-run. Several important elements include the timing for upstream migration of adults through the Delta and the timing of the downstream migration of juvenile spring-run chinook salmon.

**Juvenile Migration-** Yearling spring-run chinook salmon are present in the Delta in the vicinity of the Delta Wetlands Project islands between early October through January (Figure 2). During this period they are vulnerable to physical disturbance, entrainment, elevated water temperatures, and flow disruptions. Spring-run smolts are present in the Delta in the vicinity of the Delta Wetlands Project islands between early April through June. During this period they are also vulnerable to physical disturbance, entrainment, elevated water temperatures, and flow disruptions.

The same adverse habitat conditions described for winter-run, such as the entrainment of juveniles into the central and south Delta, also decrease survival for juvenile winter-run chinook salmon as they are drawn through the DCC and Georgianna Slough and east through Three-Mile Slough and the lower San Joaquin River.

**Adult Migration-** Adequate flows and suitable water quality are needed to ensure that adults can move upstream towards their spawning habitat and are not subjected to elevated water temperatures. The timing of adult migration varies from early January through May. The channels around Webb Tract and Bouldin Island are areas that adult spring-run may use during their upstream migration and where spring-run are vulnerable to physical disturbance and flow disruption during migratory periods.

### c. Factors Influencing Project Impacts on Delta Smelt

Attachment 4 contains significant information which helps to understand the reasons for the Reasonable and Prudent Measures. It should be carefully reviewed as a step in reviewing the rationale for the Reasonable and Prudent Measures. Several important elements include the timing for upstream migration of adult delta smelt into the Delta for spawning and the timing of spawning.

**Adult Migration-** Adequate flows, suitable water quality, and reduced diversions are needed to attract migrating adults into the Delta's Sacramento and San Joaquin river channels and their associated tributaries and ensure that adults are not subjected to elevated levels of entrainment. These areas are vulnerable to physical disturbance and flow disruption during migratory periods (Figure 2).

**Spawning-** The spawning season for delta smelt varies from year to year, and may occur from late winter (December) to early summer (July). Moyle (1976) collected gravid adults from December to April, although ripe delta smelt were most common in February and March. In 1989 and 1990, Wang (1991) estimated that spawning had taken place from Mid-February to late June or early July, with peak spawning occurring in late April and early May.

A recent study of delta smelt eggs and larvae (Wang and Brown 1994, as cited in DWR and Reclamation 1994) confirmed that spawning may occur from February through June, with a peak in April and May. The variation in timing of spawning is affected by both biological and environmental factors (Meng and Moyle 1995, Stevens and Miller 1983, Sweetnam and Stevens 1993, USFWS 1996). Examined collectively, the life history information on listed species such as delta smelt indicates that the various life stage activities may occur over broad time periods. However, when individual years are examined these various life stage activities occur over narrower windows of time. These data indicate that year-to-year variation in periodicity of the early life stages may range over several months with peaks of abundance varying considerably among months.

Although, the duration of the spawning season or period of larval transport may to be a significantly narrower window of time, actual year-to-year periods of vulnerability of each life stage are generally shorter than shown in this Biological Opinion.

The DFG used the following percentages for the monthly distribution of delta smelt larvae in the Delta and vulnerable to Delta Wetlands Project impacts (Figure 3):

February	10%	May	25%
March	25%	June	5%
April	35%		

**Larval and Juvenile Transport-** Habitat conditions suitable for transport of larvae and juveniles and larval rearing are needed by the species as early as February 1 and as late as August 31, because the spawning season varies from year to year and may start as early as December and extend until July. Although entrainment indices were calculated for all months, the transport effects on delta smelt larvae would occur primarily during February-June.

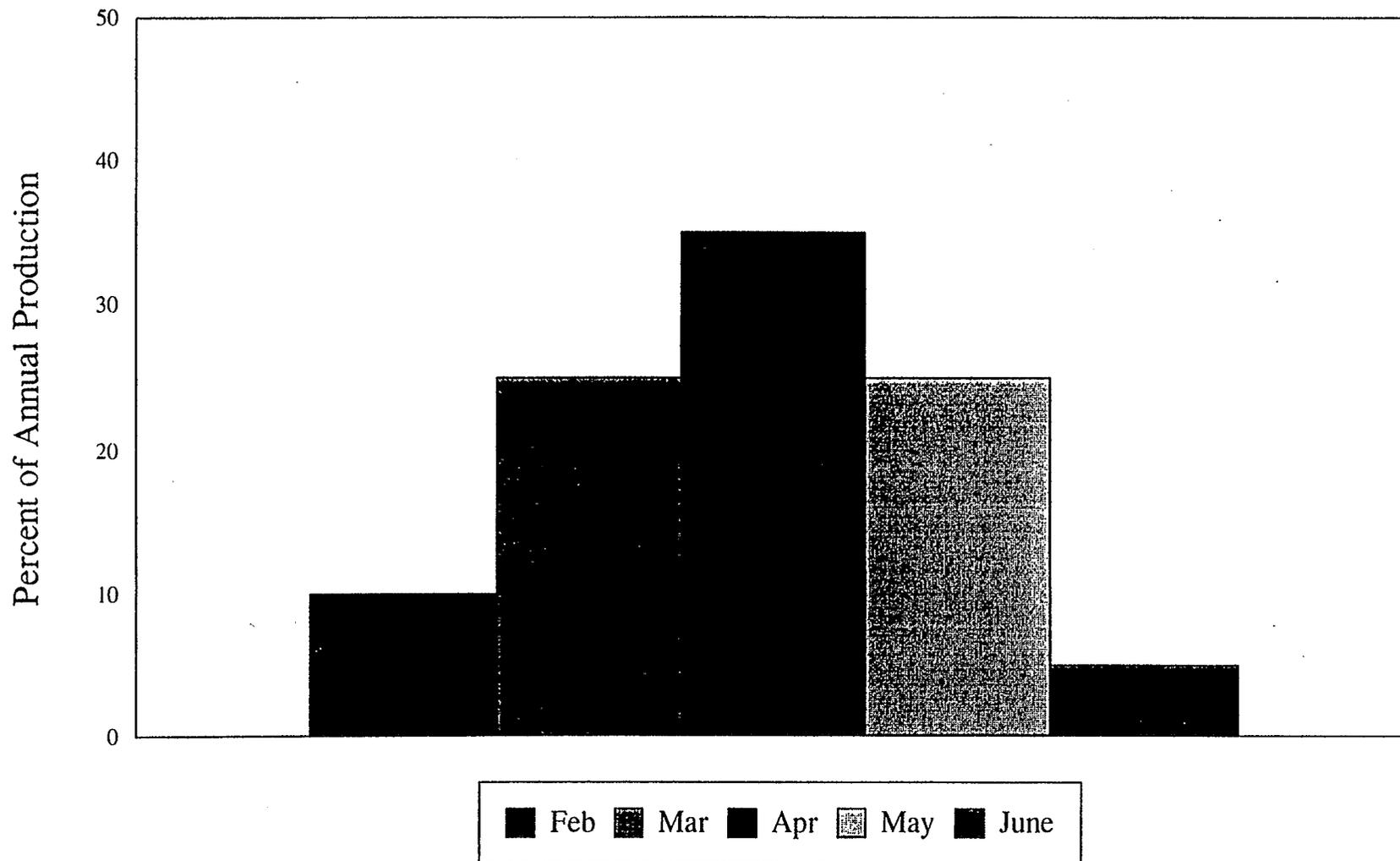


Figure 3. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Percent of delta smelt larvae present in the Delta by month.

**Rearing Habitat-** The delta smelt's principle rearing habitat is located in an area extending from Carquinez Straits, including Suisun, Grizzly, and Honker bays, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three-Mile Slough. Three-Mile Slough represents the approximate location of the most upstream extent of historical tidal excursion. Rearing habitat is vulnerable to impacts from the beginning of February to the end of August. The location of an indicator, X2, is a measure of rearing habitat quality and quantity.

#### 4. TRANSPORT CONDITIONS

Transport has been identified as important to the survival of delta smelt and winter-run and spring-run chinook salmon. Transport to the Delta export facilities reduces survival, while transport toward Suisun Bay increases survival of both delta smelt and chinook salmon. JSA described using a numerical index in the Board's Biological Assessment as a reliable indicator of transport conditions in the Delta. This "entrainment" index is calculated by JSA's DeltaMOVE model and is a function of Delta diversions, facility operations, and average tidal flows. Entrainment indices are specific to each of six areas of the Delta. For example, the entrainment index for the Mokelumne River, or northern, part of the Delta represents the portion of water originating from the Mokelumne River, Sacramento River through the DCC and Georgiana Slough (and associated particles such as fish larvae) that is potentially diverted by any Delta diversion. Under identical Delta flow and diversion conditions, entrainment indices are highest for parts of the Delta nearest the largest diversions (i.e., near the export facilities of the SWP and the CVP) in the south. The impact of diversions on transport conditions (i.e., the entrainment index) is partially determined by the geographical location of diversions and the inflow source of diverted water.

#### 5. OTHER FACTORS

The DFG recognizes the mortality rate curve differences between larval and adult delta smelt and that the earliest life phases of fish such as delta smelt, have high natural mortality rates compared to later life phases. Also, increases in larval mortality rates are unlikely to result in the same level of effects at the adult population level because of compensatory mortality/survival effects. The DFG assumed that a given rate of mortality of larval fish would not be carried, unchanged to the adult life phase consistent with accepted scientific principles in population dynamics. The DFG took these factors into account when analyzing project impacts and preparing its Biological Opinion.

The simulations of entrainment indices for delta smelt differ from the simulations for winter-run chinook salmon. Delta smelt are blocked from moving downstream of the 2-ppt isohaline and the blockage increases exposure to the effects of Delta diversions and exports, especially for larval smelt in the Sacramento River and San Joaquin River parts of the Delta.

## 2. OPERATIONAL IMPACTS

The DW reservoir islands have the capacity to store up to 238 thousand acre-feet (TAF). This is expected to gradually increase to 260 TAF due to island subsidence. As proposed, DW diversion operations will frequently reduce Delta outflow. The decrease in outflow may reach an average daily maximum rate of 9,000 cfs and an average monthly maximum rate of 4,000 cfs. Delta outflows would be reduced by 5 percent or greater in approximately 9.2 percent of the simulated years (1922-1991) with a maximum reduction of 25 percent. On an annual basis, DW diversions would directly decrease outflow by a mean of 192 TAF and a maximum of 490 TAF. In comparison, the CVP and SWP export an average of 6.1 million acre-feet per year. Water diversion onto the DW islands can increase the percent of inflow diverted in any month of the year.

Operations studies completed by JSA indicated that the project operated according to the January 27, 1997 Final Operations Criteria (Attachment 2) diverted to storage at maximum monthly rates of 3,600 cfs, 4,000 cfs, and 1,144 cfs in January, February, and March respectively (Table 2). Project diversions occurred nearly two-thirds of the time in January, February, and March and were essentially unchanged from the project originally proposed in the Board's Biological Assessment. Diversions in April and May were eliminated, however, those diversions occurred only 5 to 7 percent of the time and did not exceed monthly average flows of 76 cfs and 172 cfs respectively. This measure, therefore, avoided a relatively small impact associated with that alternative. Maximum diversions remained nearly unchanged from July through December. The frequency did decrease in December from 56 percent with the project as proposed in the Board's Biological Assessment to 40 percent for the project operated as allowed by the federal biological opinions.

The project operated as allowed by the federal biological opinions discharged for export at maximum rates of 956 cfs, 1,742 cfs, and 1,088 cfs in January, February, and March respectively (Table 3). Project discharges were reduced in December through March for the project operated as allowed by the federal biological opinions. The frequency of discharges was also reduced in February and March. The maximum amounts discharged were essentially unchanged in the months of July and August but the frequency increased substantially from the project originally proposed in the Board's Biological Assessment. Discharges increased dramatically September and October for the project operated as allowed by the federal biological opinions. No discharge occurred in September and October with the project as proposed in the Board's Biological Assessment.

Total annual diversions onto the Delta Wetlands reservoir islands as proposed in the Board's Biological Assessment ranges from zero to 501 TAF, with an average of 217 TAF. Total annual diversions, as allowed by the federal biological opinions, ranges from zero to 490 TAF, with an average of 192 TAF.

Table 2. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Frequency of Diversions During the 70 year Period of Simulation and the Maximum Diversion Rates under the Biological Assessment and ESA Alternatives (from JSA 1997).

Month	Diversions (Months)		Maximum Monthly Diversion Rate (cfs)	
	BA	ESA	BA	ESA
October	22	21	3,871	3,871
November	31	29	4,000	4,000
December	39	28	3,871	3,871
January	49	45	3,871	3,600
February	40	40	4,000	4,000
March	39	39	3,871	1,144
April	5	0	76	0
May	4	0	172	0
June	8	8	1,325	296
July	34	34	130	130
August	10	10	115	115
September	10	8	4,000	4,000

Table 3. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Frequency of Discharges During the 70 year Period of Simulation and the Maximum Discharge Rates under the Biological Assessment and ESA Alternatives (from JSA 1997).

Month	Discharges (Months)		Maximum Monthly Discharge Rate (cfs)	
	BA	ESA	BA	ESA
October	0	8	0	962
November	3	5	515	743
December	6	6	3,335	1,758
January	2	2	2,388	956
February	17	5	3,871	1,742
March	16	4	3,822	1,088
April	27	20	3,450	450
May	25	29	3,136	599
June	15	17	3,056	917
July	11	28	3,741	3,741
August	4	36	3,755	3,730
September	0	15	0	1,777

Annual discharges from the Delta Wetlands reservoir islands, as proposed in the Board's Biological Assessment, ranged from zero to 378 TAF, with an average of 197 TAF. Annual discharges from the Delta Wetlands reservoir islands, as allowed by the federal biological opinions, ranged from zero to 306 TAF, with an average of 154 TAF.

Figures 4 and 5 illustrate the levels of diversions and discharges that occur with the project as allowed by the federal opinions. Figure 4 illustrates diversion data for months during which project operations actually occur, therefore, the average impacts are not just the average for the 70 years simulated. The federal opinions allowed for increased diversions averaging 908 cfs, 871 cfs, and 172 cfs in the period January through March. The peak diversion months are September through November.

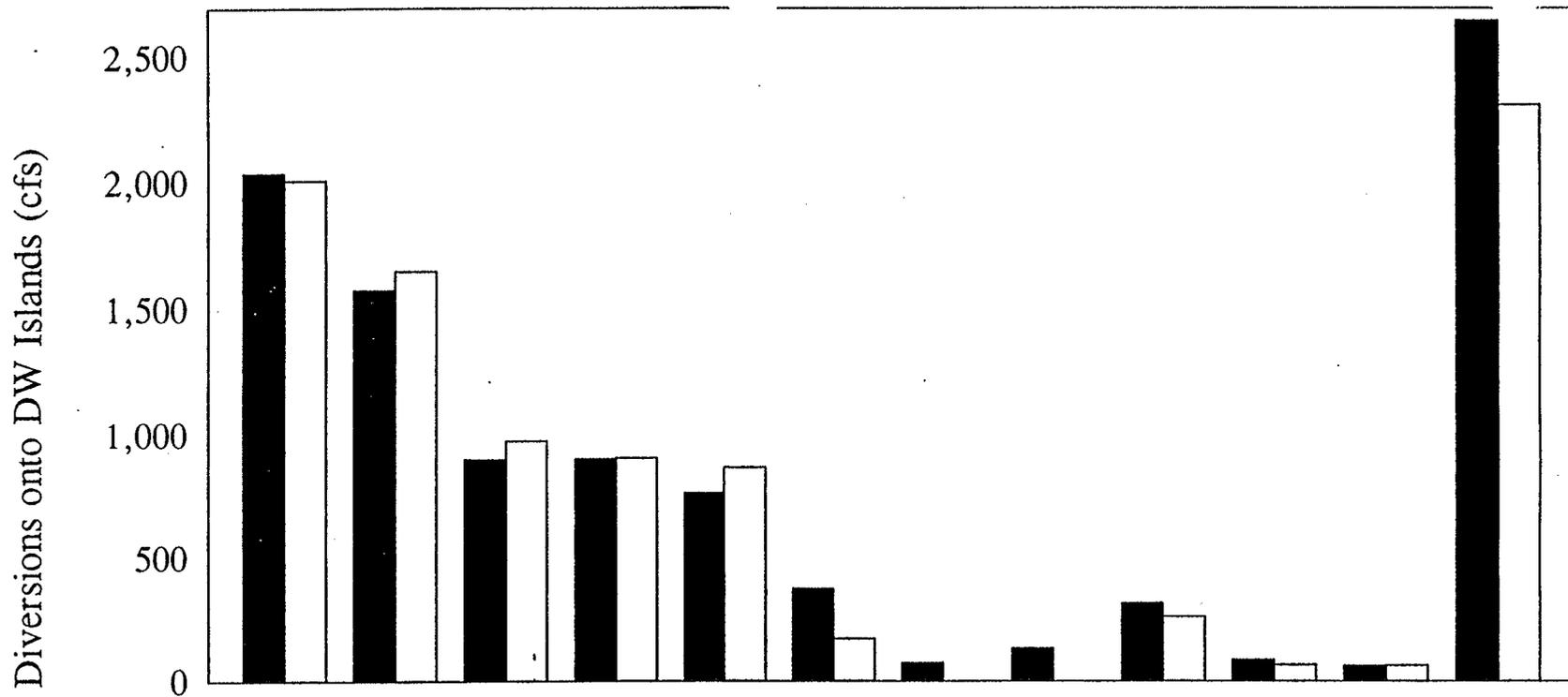
Figure 5 illustrates the level of discharges to export that occur with the project as allowed by the federal opinions. This figure illustrates data for months during which project operations actually occur, therefore, the average impacts are not for the 70 years simulated. The federal opinions allowed for increased discharges and exports averaging 1,172 cfs, 629 cfs, 1,098 cfs, and 503 cfs in the period December through March.

### **3. FLOW AND HYDRODYNAMIC IMPACTS**

#### **a. Winter- and Spring-run Chinook Salmon**

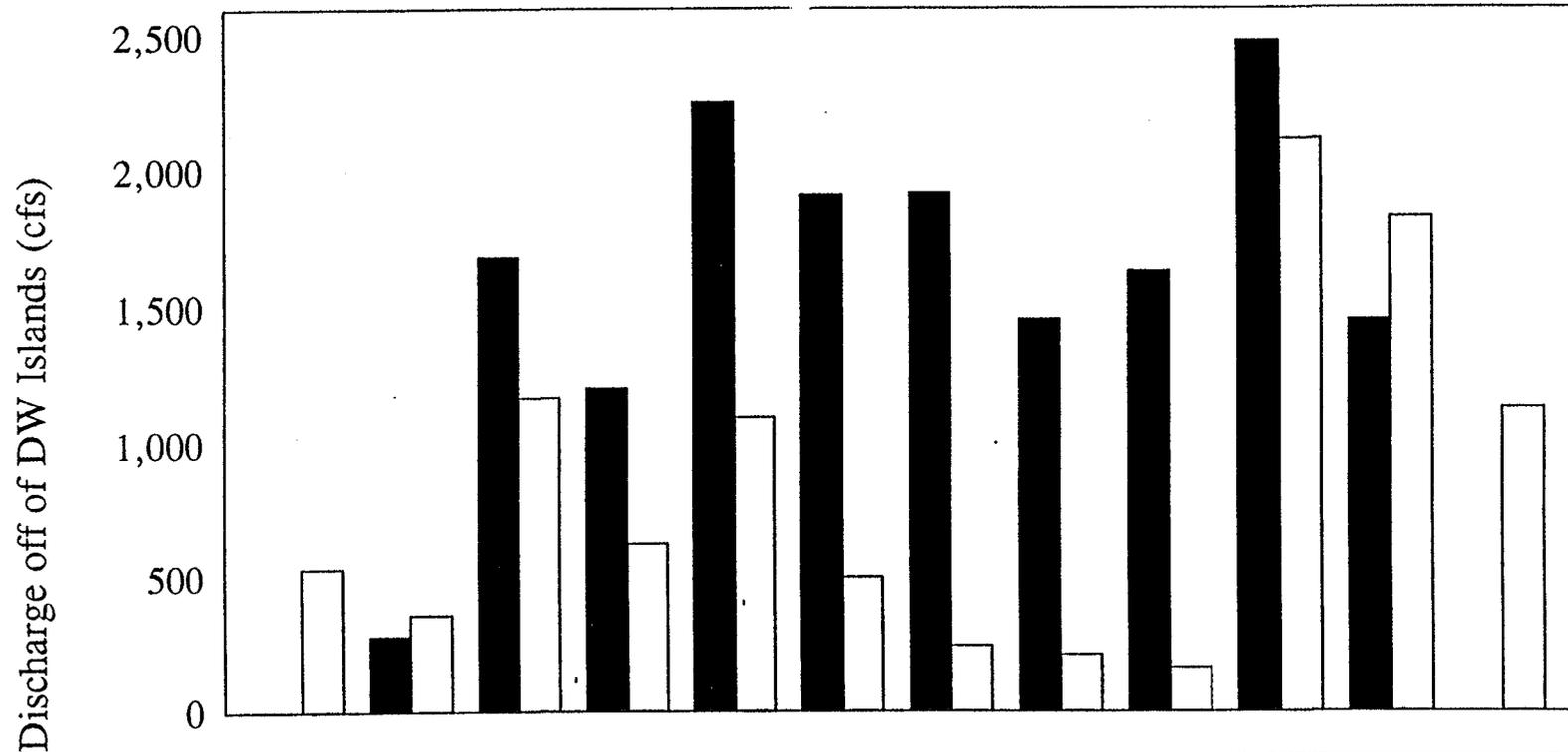
Changes in Delta hydrodynamics resulting from the diversions shown in Table 2 during the critical rearing and migration period for juvenile winter-run chinook salmon is expected to adversely affect the species. Decreases in Delta outflow, increases in export/inflow levels, and reduction in QWEST are likely to reduce the survival of rearing and emigrating juvenile fish. Existing reverse flows conditions in the lower San Joaquin, Old, and Middle rivers will be exacerbated by Delta Wetlands diversions. Natural flow cues for emigrating winter-run chinook salmon smolts and migrating adults will be adversely affected. The number and rate of juvenile winter-run chinook salmon drawn from their typical migration route into central and southern Delta waterways is also likely to increase.

Lower survival rates are expected due to the longer migration route, where fish are exposed to increased predation, higher water temperatures, unscreened diversions, poor water quality, reduced availability of food, and entrainment at the CVP/SWP export facilities. Through reduced Delta outflow and decreases in net westerly flow, Delta Wetlands diversions are expected to degrade chinook salmon rearing habitat in the Delta, degrade conditions for migrating juvenile winter-run chinook salmon. Increased diversions interfere with the natural



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept
<b>BA</b> ■	2,039	1,577	902	904	767	373	75	136	316	89	64	2,651
<b>ESA</b> □	2,011	1,653	977	908	871	172	0	0	261	68	66	2,312

Figure 4. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Modeled diversions onto the Delta Wetlands reservoir islands for the Biological Assessment and ESA alternatives. Zero values were not factored into monthly averages. (Source: JSA)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept
<b>BA</b> ■	0	284	1,685	1,207	2,257	1,913	1,921	1,460	1,634	2,481	1,458	0
<b>ESA</b> □	537	365	1,172	629	1,098	503	248	214	166	2,119	1,833	1,132

Figure 5. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Modeled discharges from the Delta Wetlands reservoir islands for the Biological Assessment and ESA alternatives. Zero values were not factored into monthly averages. (Source: JSA)

smolt outmigration stimulus and seaward orientation, and generally reduce smolt survival. During dryer water year types, Delta Wetlands diversions have an even greater potential for adversely affecting channel hydrodynamics and reducing winter-run chinook salmon survival

already strained by low flows, poor water quality, and high CVP/SWP entrainment rates. Delta outflow decreased by an average of 2,011 cfs, 1,653 cfs, 941 cfs, 853 cfs, 848 cfs, and 98 cfs in the October through March period (Figure 6).

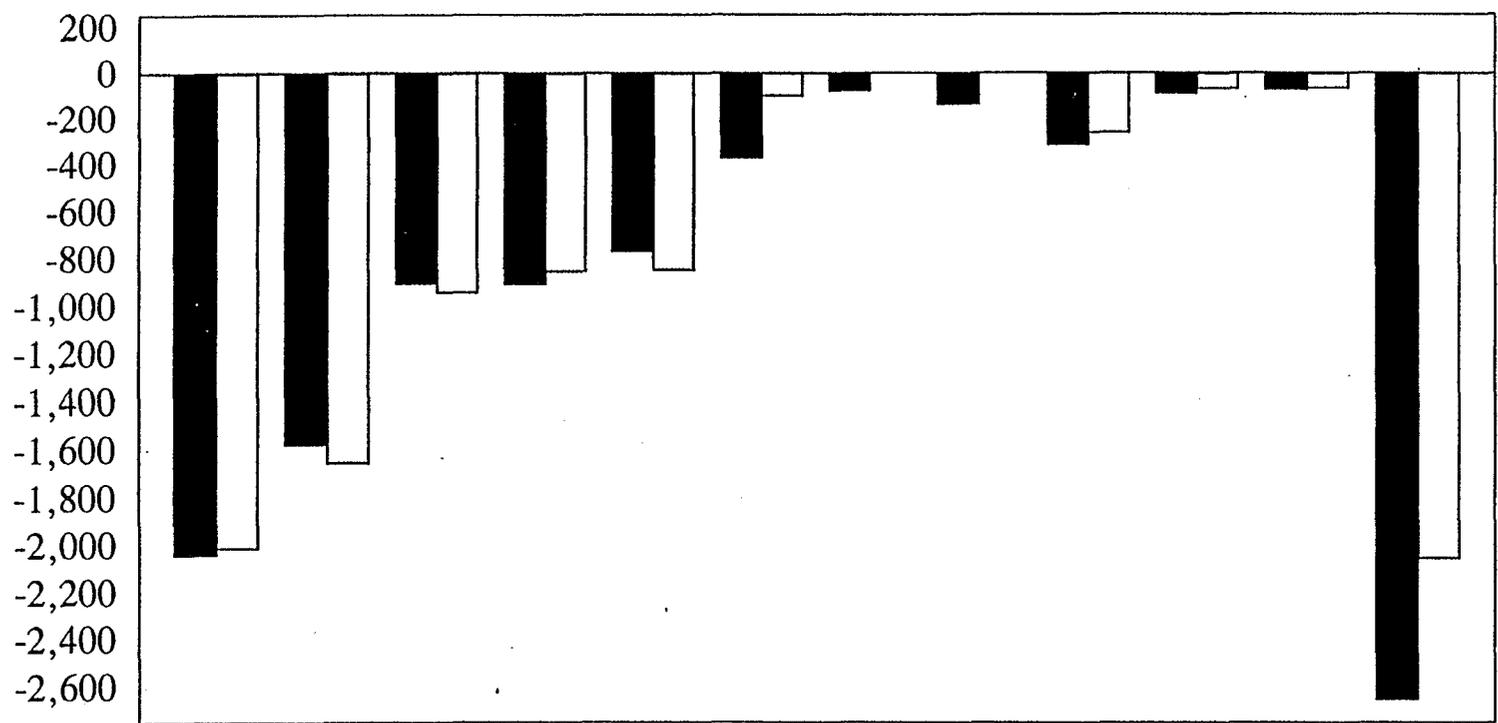
Discharges from the Delta Wetlands islands would occur during critical rearing and emigration periods of the juvenile winter-run chinook salmon. These discharges to export at the CVP/SWP pumping plants will increase the reverse flows in Old and Middle rivers by up to 1,765, 1,161, 500, and 660 cfs during February, March, April, and May, respectively. These changes represent increases of 25 percent, 19 percent, 8 percent, and 10 percent compared to current conditions. Impacts from low river flows, poor water quality, and high CVP/SWP entrainment rates during drier water year types will be exacerbated by Delta Wetlands discharges for export.

#### b. Delta Smelt

Changes in Delta hydrodynamics resulting from the diversions shown in Table 2 during the period when adult delta smelt are migrating upstream into the Delta (December-March) and during portions of the critical spawning and rearing period for larval and juvenile delta smelt (February-June) will adversely affect the species. Decreases in Delta outflow, shifts in the position of X2, increases in export/inflow levels, and reduction in QWEST will reduce the survival of spawning, rearing, and emigrating juvenile fish. Existing reverse flows conditions in the lower San Joaquin River, Old River, and Middle River will be exacerbated by Delta Wetlands diversions. Natural transport flows and cues for larval and juvenile delta smelt and migrating adults will be adversely affected.

Lower survival rates are expected because fish are exposed to increased predation, higher water temperatures, unscreened diversions, poor water quality, reduced availability of food, and entrainment at the export facilities. Through reduced Delta outflow and decrease net westerly flow, Delta Wetlands diversions will degrade delta smelt spawning and rearing habitat in the Delta, degrade conditions for natural transport flows westward, and generally reduce delta smelt survival. During dryer water year types, Delta Wetlands diversions have an even greater potential for adversely affecting channel hydrodynamics and reducing delta smelt survival already strained by low flows, poor water quality, and high CVP/SWP entrainment rates. Discharges would occur during critical periods of adult upstream migration into the Delta for spawning, and during critical periods for larval and juvenile delta smelt.

Delta Outflow (cfs)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept
<b>BA</b> ■	-2039	-1577	-902	-904	-767	-373	-75	-136	-315	-89	-72	-2651
<b>ESA</b> □	-2011	-1653	-941	-853	-848	-98	0	0	-261	-68	-66	-2055

Figure 6. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Average monthly changes in Delta outflow for a 70 year period. Minus values indicate outflow was decreased due to project operations. Values are shown for the BA and ESA Alternatives. Zero values were not factored into monthly averages. (Source: JSA)

Discharges for export will increase the reverse flows in Old and Middle rivers by up to 1,765, 1,161, 500, and 660 cfs during February, March, April, and May, respectively. These changes represent increases of 25, 19, 8, and 10 percent compared to current conditions. Impacts from low river flows, poor water quality, and high CVP/SWP entrainment rates during drier water year types will be exacerbated by Project discharges for export.

Indicators of adverse hydrodynamic conditions in the north and central Delta, the CDFP, showed increases of 37, 30, 42, 58, and 17 percent above baseline conditions during these same months. These adverse changes are directly linked to reduced survival of juvenile winter-run salmon and delta smelt.

Delta Wetlands will directly and indirectly reduce the survival of adult, larval and juvenile delta smelt in the Delta. Decreases in Delta outflow, higher net southerly flows in Old and Middle rivers, and decreases in QWEST adversely affect delta smelt primarily through increased entrainment into the central and south Delta waterways where they are subject to longer migration routes, increased predation, unscreened diversions, poor water quality, decreased westward flow cues, and losses at the CVP/SWP export facilities.

#### 4. ENTRAINMENT IMPACTS

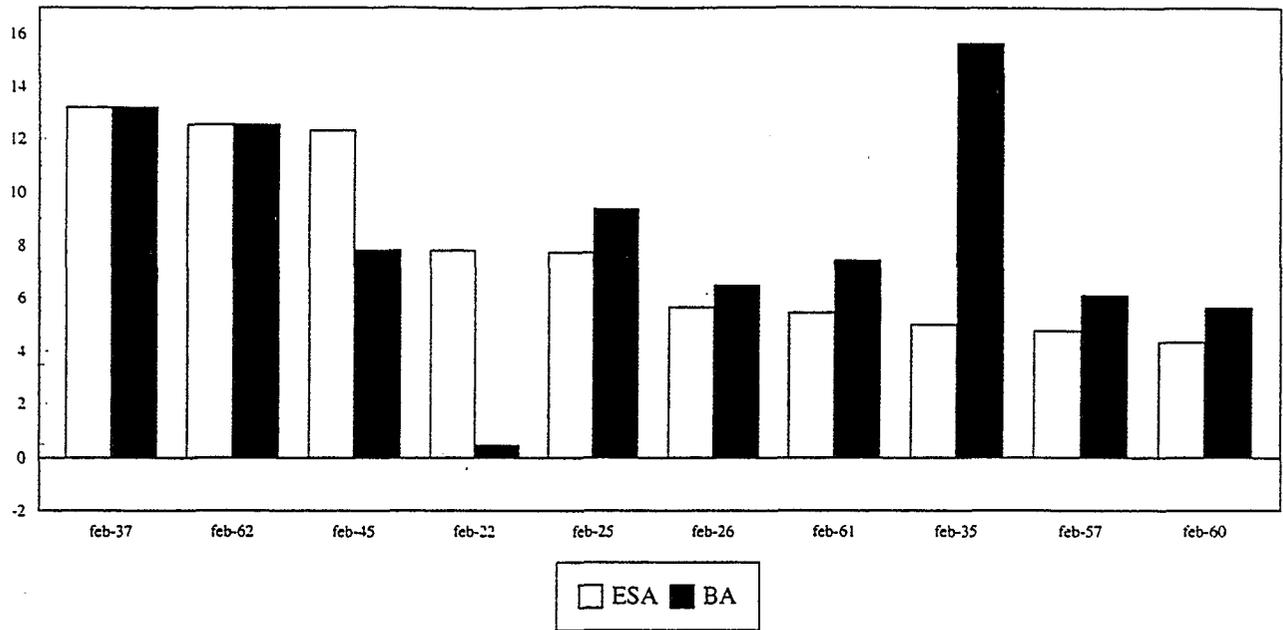
Figure 7 illustrates the results of the DeltaMOVE model for winter-run and delta smelt for the month of February. For the highest 10 years evaluated for the project as allowed by the federal opinions, winter-run chinook salmon mortality, measured by the entrainment index, increased between 4.3 and 13.2 compared with 0.5 and 15.6 for the project proposed in the Board's Biological Assessment.

For the highest 10 years evaluated for the project as allowed by the federal biological opinions, entrainment indices for larval delta smelt increased between 0.9 and 1.5 compared to 0.3 and 1.6 for the project proposed in the Board's Biological Assessment.

#### 5. WATER QUALITY

Discharges would impact water quality by increasing water temperatures and decreasing dissolved oxygen. In April, May, and September Delta water quality conditions are often poorly suited for supporting rearing and migrating salmonids. At channel temperatures above 58 ° F, increases of more than 1° F in the channel can result in physiological sublethal stress, impair predation avoidance abilities, terminate smoltification, and cause migration delays or blockages (Boles 1982; Wedemeyer et al. 1980; and Zaugg and Adams 1972).

Winter-run Salmon Entrainment Index



Delta Smelt Entrainment Index

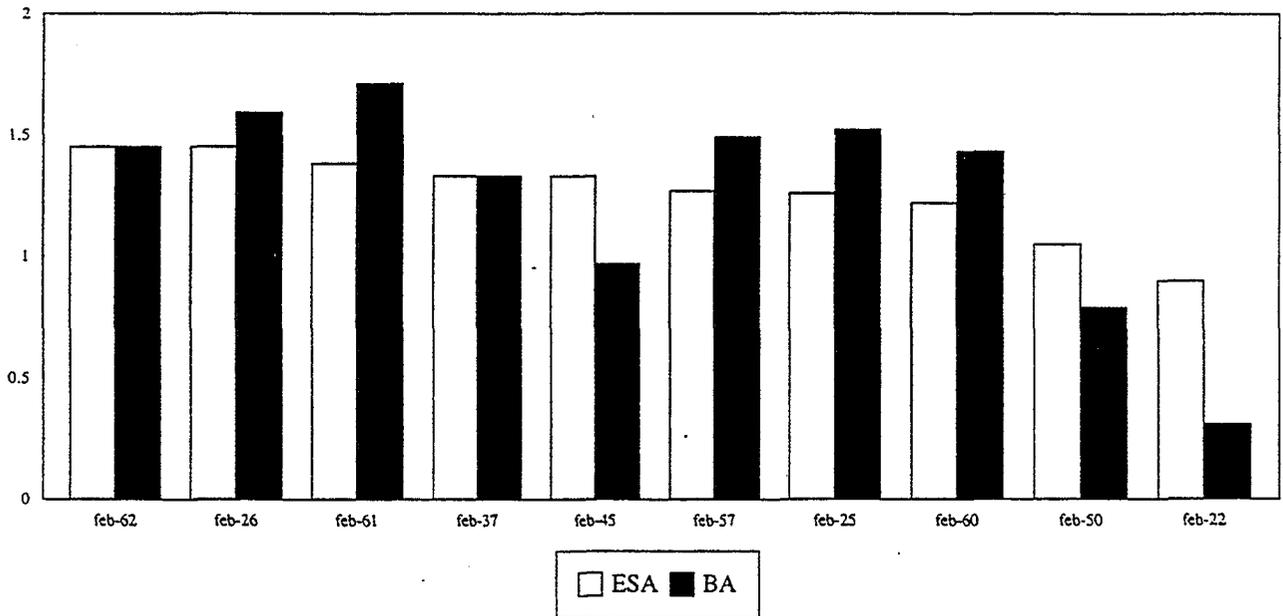


Figure 7. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. February entrainment indices for winter-run Chinook salmon and delta smelt. Comparison between project proposed in the Board's BA and project under the federal biological opinions. Delta smelt indices are noted at the bottom, winter-run indices are noted at the top. Note: Scale used to present indices differs between the two species.

The extent of the risk posed by project discharges cannot be conclusively assessed without data such as reservoir island water temperatures, DO levels, and levels of biological oxygen demand, specific channel temperatures, tidal conditions, and net channel flows. Since these data were not provided during consultation, DFG biologists used the best available information to assess the impacts of the water quality criteria allowed in the federal biological opinions. Channel water impacts were estimated using calculations based on the same steady state model used by Delta Wetlands in support of its criteria. Modeling suggested that reservoir releases of as little as 900 cfs from a reservoir island when channel flow is about 3,800 cfs can overwhelm a channel's cross section and increase water temperatures by more than 2° F when reservoir temperature differences are as low as 10 ° F above the channel temperature.

In a recent review of thermal conditions in the Delta, Winternitz and Wadsworth (1997) summarized mean monthly water temperatures for 1996 at various sites within the Delta. The data demonstrate that existing conditions for winter-run chinook salmon in the Delta can already be thermally stressful. Data collected at five locations showed average monthly temperatures as high as 62 ° F in April and 67 ° F in May. June temperatures ranged from 67 to 74 ° F. In September, temperatures ranged from 68 to 74 ° F. In October, temperatures ranged from 63 to 68 ° F. The January 27, 1997 Final Operations Criteria (Attachment 2) included in the federal opinions may allow increases above these levels that would cause significant increased take of winter-run chinook salmon.

## VII. ANALYSIS OF FEDERAL BIOLOGICAL OPINIONS

As discussed in Section III, CESA encourages coordination between State and federal agencies for consultations concerning projects that may affect species listed under ESA as well as CESA. The DFG has worked closely with the federal wildlife agencies. Through mid-1996, consultation between the DFG and the federal fish and wildlife agencies was cooperative and simultaneous. All three agencies jointly developed an "Aquatic Resources Management Plan" using the best scientific information available and the analytical tools in the Biological Assessment for the project. This plan formed the basis of discussions with Delta Wetlands and ultimately formed the foundation of the USFWS draft biological opinion. In mid-1996, consultation meetings began to focus on direct discussions between Delta Wetlands and the USFWS and NMFS. The DFG continued to attend those meetings, but the DFG's concerns were not directly discussed or otherwise addressed. Subsequently, pursuant to discussions between the federal agencies and Delta Wetlands, significant measures in the plan were modified or deleted. Elimination or modification of those measures with no alternative, equivalent protection, may result in inadequate protection of delta smelt or winter-run chinook salmon and the Project inadequately addressing take of delta smelt and winter-run.

At various times throughout the DFG's consideration of the Delta Wetlands Project, representatives from Natural Resources Consulting Scientists, HYA Consulting Engineers, and Delta Wetlands's legal representatives, the Ellison and Schneider Law Firm, as well as various technical and biological consultants, attended consultation meetings to discuss the effects of the Delta Wetlands Project on listed fish species and their habitat.

CESA requires the DFG to adopt a federal biological opinion as its written findings for a state lead agency's proposed project if it is possible to do so and would be consistent with CESA. The DFG here adopts, in part, the federal biological opinions prepared by the USFWS and NMFS for the Delta Wetlands Project. The DFG has determined that the project, if implemented according to the January 27, 1997 final operating criteria and federal biological opinions, would not jeopardize the continued existence of winter-run chinook salmon and delta smelt. The DFG hereby adopts the federal biological opinions insofar as they address jeopardy to winter-run chinook salmon and delta smelt. As further explained below, however, the DFG has determined that the federal biological opinions may not adequately minimize the adverse impacts of the incidental taking of winter-run chinook salmon and delta smelt, as provided in Section 2091. Consequently the DFG declines to adopt the federal biological opinions insofar as they adequately address the incidental taking of the winter-run chinook salmon; to do so would not be consistent with CESA. Specifically, the DFG's adoption of the federal biological opinions as its written findings regarding the incidental taking of winter-run chinook salmon and delta smelt for its consultation with the Board concerning the Delta Wetlands Project would conflict with Fish and Game Code §2052, 2055, and 2091. In order to adequately address take the DFG, therefore, adopts the final operating criteria dated January 27, 1997 which are contained in the federal biological opinions along with additional Reasonable and Prudent Measures contained in this Biological Opinion as necessary and appropriate to minimize the adverse effects of take of winter-run chinook salmon and delta smelt.

The federal biological opinions allow significant increased diversions and associated impacts for winter-run chinook salmon during the peak months of February and March when between 40 and 50 percent of the year's production can be located in the Delta and are vulnerable to project impacts. Impacts, using an indicator of adverse hydraulic conditions in the central Delta, may increase by up to 80 percent.

February and March are also critical months for delta smelt. Adults are entering the Delta for spawning and larval smelt are present in significant numbers. Ten and 25 percent of the total population of delta smelt are present in the Delta during those months respectively. Impacts, measured as changes in entrainment of larvae into Delta diversions associated with the Delta Wetlands Project, may increase by up to 75 percent.

During initial discussions among the State and federal fish and wildlife agencies, agency biologists agreed that a common goal was to ensure that significantly increased diversion impacts should be avoided in the February and March period. To achieve that goal, the USFWS recommended several operations criteria that were agreed to by Delta Wetlands

and included in the Final Operations Criteria dated January 27, 1997. Unfortunately, the expected benefits may not be realized. Restrictions are so limited in duration (15 days) that in a given month, protection will be lost for that month when project diversions are allowed to immediately increase diversions when the 15 days have expired.

In addition, the federal opinions provide only minimal protection because the percentages allowed in those opinions are too high and, when the FMWT index is  $>239$  project operations those limits can only be invoked for 15 of 120 days; the rest of the time there is no additional limit and, therefore, no protection. The limited number of days may provide little benefit in most years and implementation could be problematic. Agencies will be reluctant to invoke the limits early in the season and, therefore, if diversion opportunities do not occur in February or March no reductions will occur and project impacts will not be reduced.

Modeled benefits indicate that the measures were not successful in reducing impacts to the level necessary and appropriate to minimize the adverse impact of incidental taking. Modeling, furthermore, overestimated the benefits suggested by the modeling output since the results are derived from a monthly model which applies the measure for an entire month instead of the actual 15 days.

Project operations, allowed by the federal biological opinions during February and March, account for much of the remaining adverse impacts associated with the incidental take of winter-run chinook salmon and delta smelt.

The federal opinions contain only a small amount of environmental water. The expectation was that the fraction of water that was not to be exported would provide benefits at certain times and would help offset take of listed fish due to adverse hydraulic changes and flow patterns in Old and Middle rivers. Unfortunately, in 4 of 5 years the volume of discharges from the habitat islands will be nearly equal to the volume intended to reduce incidental take. Therefore, in most years, little or no water will be released from the reservoir islands to add to Delta outflow or contribute to offsetting adverse hydraulic conditions in order to reduce take.

The adverse impacts of take in October through June may not be adequately minimized with the avoidance or mitigation measures included in the project as allowed by the federal biological opinions.

#### **DIFFERENCES BETWEEN FEDERAL OPINIONS AND DFG'S OPINION**

Differences between the federal opinions and the DFG's CESA biological opinion include:

- The limits associated with higher delta smelt indices ( $>239$ ) offer no significant reduction in the take of delta smelt and offer little or no take reduction for

winter-run chinook salmon. While measures described in the federal opinions which are tied to lower delta smelt indices (<239) will reduce impacts below levels that were calculated by JSA for the federal biological opinions, effective protection will occur in only 1 in 5 years if the pattern established over the last 20 years is repeated (Attachment 6). Furthermore, since no relationship has been established between a given year's abundance of larval and juvenile delta smelt and a previous year's FMWT index, this increased level of protection will only rarely be provided when it is needed. The DFG, therefore, concludes that additional specific operational criteria during March are necessary and appropriate to minimize the adverse impacts of incidental taking.

- Measures described in the federal biological opinions for environmental water during discharges are inadequate to offset the unavoidable impacts associated with project operation. Furthermore, provisions to credit drainage from the habitat islands, reduces the value of releasing water from reservoir islands for environmental purposes to benefit listed fish. The resulting releases required in the federal biological opinions only infrequently result in benefits that can offset other project impacts. The DFG, therefore, concludes that additional provisions for environmental water are necessary and appropriate to minimize the adverse impacts of incidental taking.
- The federal biological opinions do not include adequate compensation for impacts to delta smelt rearing habitat caused by upstream shifts in X2 related to Project operations. The DFG, therefore, concludes that providing compensation through the restoration of rearing habitat is necessary and appropriate to minimize the adverse impacts of incidental take.

## VIII. DFG FINDINGS

The DFG's CESA Biological Opinion is based, in part, on the following information: the Corps' and Board's June 21, 1995, Biological Assessment (Corps and Board 1995a); the draft Environmental Impact Report/Environmental Impact Statement for the Delta Wetlands Project (Corps and Board 1995b); numerous meetings between the DFG, USFWS, NMFS, Board, Corps, Delta Wetlands, and JSA; supplemental information and analyses provided to meeting participants; computer model simulations; existing literature on the life history of Listed Species and potential candidate species; and, personal communications with DFG species and water quality experts.

Pursuant to Fish & Game Code §2090, DFG finds and determines as follows:

1. Based on the best available scientific information, the DFG finds that the Project described in this Biological Opinion, including the Habitat Management Plan, and the measures in the attached federal biological opinions, would not jeopardize the continued

existence of the greater sandhill crane, Swainson's hawk, or other terrestrial Listed Species or result in the destruction or adverse modification of habitat essential to the continued existence of these species. This finding is specifically contingent on the Board requiring full implementation of and adherence to all provisions of the Habitat Management Plan, as proposed, as a condition of Delta Wetlands' water right permit.

2. Based on the best available scientific information, the DFG finds that the Project, as described in this biological opinion and the measures in the attached federal biological opinions would not jeopardize the continued existence of the winter-run chinook salmon and delta smelt and would not result in the destruction or adverse modification of habitat essential to the continued existence of these species.

3. Based on the best available scientific information, the DFG finds that the Project, as described in this Biological Opinion, along with the measures in the attached federal biological opinions, would result in the incidental take of individuals of the Listed Species such as giant garter snake, yellow-billed cuckoo, black rail, Swainson's hawk, greater sandhill crane, winter-run chinook salmon, and delta smelt. The adverse impacts of the taking of these species incidental to the Project will be minimized if the measures specified in Section IX-A are fully implemented and adhered to.

4. Based on the best available scientific information, the DFG finds that the protection, enhancement, and long-term management of suitable habitat for the Listed Species is essential to offset the Project's adverse impacts on the Listed Species.

As modified with the following Reasonable and Prudent Measures, the Delta Wetlands Project would not interfere with or foreclose opportunities to restore the ecological health of the estuary currently being pursued by the CALFED Bay-Delta Program.

The adverse impacts of the project on listed wildlife in the service areas of the SWP and CVP such as the San Joaquin antelope squirrel, giant kangaroo rat, Morro Bay kangaroo rat, Tipton kangaroo rat, and San Joaquin kit fox, would be reduced by implementing the DFG's recommendations in Section XIII-C.

## **IX. REASONABLE AND PRUDENT MEASURES**

As described in Section III, where the DFG has made an incidental take finding, it must determine and specify to the State lead agency Reasonable and Prudent Measures that are necessary and appropriate to minimize the adverse impacts of the incidental taking.

If the project complies with the applicable measures specified by the DFG, taking that is incidental to the project is not prohibited by CESA. If the project does not comply with the

DFG's measures, take incidental to the project is prohibited by Fish & Game Code §2080.

Pursuant to Section 2093, the DFG has consulted with the Board and consistent with Section 2094, with the project proponent. Pursuant to Section 2091 the DFG has determined that the RPMs are necessary and appropriate to minimize the adverse impacts of incidental taking. The Board must require Delta Wetland to comply with the requirement of the RPMs.

It is the policy of the DFG to maintain the integrity of the December 14, 1994 Accord. Operations under the Accord represent the baseline below which jeopardy exists for the delta smelt and winter-run chinook salmon. Given the scientific and policy consensus on maintaining and improving biological protection during the February through June period, it is necessary to avoid or minimize any additional adverse impacts of take during those periods rather than attempt to mitigate for additional adverse impacts on the Listed Species. By increasing exports, the proposed Delta Wetlands Project could also undermine the biological protections for the November through January period contained in the 1995 WQCP, which assume existing diversion capacity. This period is important for yearling spring-run chinook salmon.

Pursuant to Fish and Game Code §2091, the DFG determines and specifies the following Reasonable and Prudent Measures for the Project that are necessary and appropriate to minimize the adverse impacts of the incidental taking of Listed Species. Any taking that is in compliance with the measures prescribed in this Biological Opinion is not prohibited by CESA.

The following describes the DFG's Reasonable and Prudent Measures for the Delta Wetlands Project and outlines how the project shall be managed to minimize the adverse impacts of the incidental taking of Listed Species. The Reasonable and Prudent Measures (RPMs) include:

- A measure that reduces entrainment of listed fish and reduces loss of fish due to the adverse effects of hydrodynamic changes on listed fish during project filling and during project discharges and rediversion at the State and Federal water export facilities.
- A measure that reduces take of listed fish by improving hydrodynamic conditions during periods critical to listed fish in the Estuary in order to offset unavoidable impacts during other periods of operation.
- Measures to ensure take of listed fish due to impacts on aquatic habitat are minimized.

- A measure related to fish screens to minimize take of listed fish.
- Measures that reduce take of terrestrial listed species by managing lands on Boudin Island and Holland Tract (Figure 8).

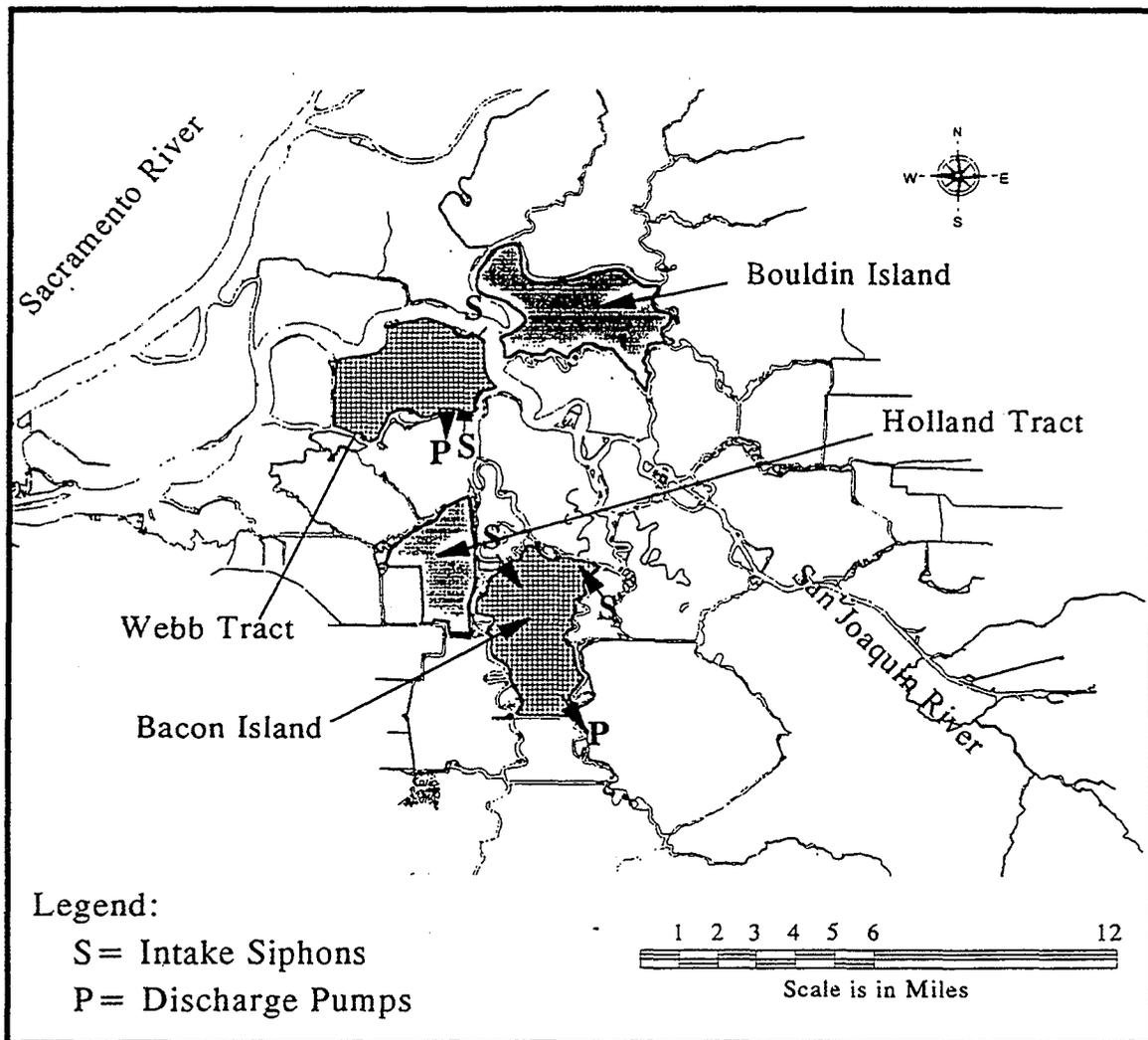
The RPMs focus on actions that directly avoid or reduce project impacts that result in take of winter-run chinook salmon and delta smelt. Project operations are modified to reduce take of listed fishery resources associated with water exports at key times to help offset some of the remaining, unavoidable losses that occur during project operations.

The RPMs can be implemented in a manner consistent with the intended purpose of the action and can be implemented consistent with the scope of the Board's legal authority and jurisdiction. In the DFG's view, the RPMs are necessary and appropriate to minimize the adverse impacts of incidental taking and will not require significant project modifications.

The RPMs are capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors. Unless modified by the RPMs, the project will continue to cause significant adverse impacts to both delta smelt and winter-run. Hydrodynamic changes associated with the project, as proposed and allowed by the federal biological opinions, will degrade important ecosystem functions and Delta outflow, QWEST, and other important indicators of the environmental health of the Delta's aquatic ecosystem will be reduced.

The Accord set the new baseline from which the CALFED Bay-Delta Program could move forward in restoring the health of the estuary. The RPMs are protective of that baseline and the Delta's aquatic Listed Species and are consistent with the new paradigm that began with the 1994 Water Accord.

Delta Wetlands shall implement the following measures in addition to those listed in the final operations criteria dated January 27, 1997. In any instance where two or more conditions apply, the condition that is the most restrictive on Delta Wetlands Project operation shall control.



 Project Lands  
 Habitat Management Lands

Figure 8. California Endangered Species Act Biological Opinion for the Delta Wetlands Project. Management Area.

## A. REASONABLE AND PRUDENT MEASURES

Following are the DFG's Reasonable and Prudent Measures. They are comprised of measures that address both terrestrial and aquatic species and are necessary to minimize the adverse impacts of take of the Listed Species. In the absence of these measures unacceptably high levels of take would occur.

- 1.0 **March Restrictions:** This measure is necessary to minimize the adverse impacts of take of winter-run and delta smelt.
  - 1.1 Delta Wetlands diversions to storage in the month of March shall be limited to a maximum diversion rate of 550 cfs unless the previous day's QWEST is positive and is calculated to remain positive during the current day's Delta Wetlands diversions to storage.
  - 1.2 Diversions to storage during March shall occur through screened diversions in a manner that reduces the hydraulic effects in adjacent channels by spreading diversions among the project's intake siphons rather than maximizing diversions through the minimum number of siphons.
- 2.0 **Environmental Water Fund:** This measure is necessary to minimize the adverse impacts of take of winter-run and delta smelt.
  - 2.1 An "Environmental Water Fund" (Fund) shall be established by Delta Wetlands. The Fund shall exclusively benefit and be controlled by the DFG. At the DFG's discretion, the Fund may be used to buy water each year, saved for use in drier years, or used for other environmental enhancement opportunities.
  - 2.2 Funding shall be based on the amount of "Net Environmental Water" calculated using the criteria in RPM 2.4. Funds shall be provided by Delta Wetlands to the DFG on or before July 31 in any year in which there is Net Environmental Water. Concurrent with providing the funding, Delta Wetlands shall provide the DFG with a final report which displays the calculations used to determine the amount of Net Environmental Water.
  - 2.3 Funds shall be provided by Delta Wetlands to the DFG at the rate of \$50 per acre-foot in January 1998 dollars, adjusted for inflation as specified in this CESA Biological Opinion. The DFG shall deposit any money received from this RPM into the Fund.
  - 2.4 The amount of "Net Environmental Water" that is calculated for the purpose of determining the amount of funds that Delta Wetlands provides the DFG for

deposit into the Fund shall be calculated as follows:

- 2.4.1 A calculation shall be made of the volume of water diverted by Delta Wetlands that is equal to five (5) percent of all diversions to storage that occur from October 1 through March 31.
- 2.4.2 One-half of the net habitat island discharges shall be credited against the calculation in 2.4.1. The calculation of net habitat island discharges to determine the credit shall be made by subtracting total diversions onto the habitat islands from total discharges off of the habitat islands in the February through June period. Attachment 6 contains a table to illustrate the method.
- 2.4.3 Net Environmental Water shall be calculated by subtracting the amount of environmental water provided by Delta Wetlands' Discharge Measure 6 of the Project's January 27, 1997 Final Operations Criteria (FOC) and used by the DFG from the total amount of Environmental Water calculated in 2.4.1 and 2.4.2. Any positive value shall be used to calculate the amount of Delta Wetlands' funding obligation as described in 2.2 and 2.3.
- 2.4.4 The "Net Habitat Island Credit (HIC)" used in Delta Wetlands' Discharge Measure 6 of the Project's FOC shall be calculated by Delta Wetlands on a real-time basis in the February through June period. Delta Wetlands shall keep daily accounting of cumulative discharges off of and diversions onto the habitat islands as well as a cumulative total of discharges from the reservoir islands for export. A calculation shall be made daily of the amount of environmental water provided and available under Discharge Measure 6 of the FOC. This daily calculation shall be provided to the DFG within 48 hours.
- 2.4.5 The net habitat island discharges and net HIC used to define the potential amount of habitat island discharges that may be credited against the environmental water in this RPM and the environmental water in Discharge Measure 6 of the Project's January 27, 1997 FOC respectively shall be based on the actual measurement of the volume of water diverted and discharged at all habitat island intakes and drains. The final methodology for making and documenting these measurements shall be developed by Delta Wetlands after the issuance of the water rights permit and must be accepted, in writing, by the DFG prior to project operations. In the event the required measurements are not made, the net habitat island discharges and HIC shall be based on the water budget for the habitat islands contained in Table A1-8 of Appendix A-1 of the

project's DEIR/EIR (included in Attachment 6 of this CESA Biological Opinion).

- 2.5 The Net Environmental Water, calculated in 2.4.1, 2.4.2, and 2.4.3 for the purpose of determining the amount of the funding obligation, combined with the environmental water provisions of the January 27, 1997 FOC shall not exceed 20 TAF in any water year.
  - 2.6 Delta Wetlands shall, by the end of each March, provide DFG a report on the estimated amount of environmental water calculated for the year to date.
  - 2.7 Delta Wetlands shall provide an initial installment of \$300,000 for the Fund. That installment shall be provided to the DFG prior to the commencement of diversions to storage.
- 3.0 **Habitat Management Lands:** This measure is necessary to minimize the adverse impacts of take of Swainson's hawk and greater sandhill crane.
- 3.1 Delta Wetlands shall acquire, preserve, and enhance the Habitat Management (HM) lands as expressly provided for in the HMP as detailed in Attachment 3 of this CESA Biological Opinion. Delta Wetlands shall conduct the protection and enhancement activities with respect to the Swainson's hawk and greater sandhill crane described in the HMP as detailed in Attachment 3 of this CESA Biological Opinion and shall undertake the activities and management measures described in this paragraph.
  - 3.2 Delta Wetlands shall acquire approximately 8,957 acres of HM lands on Bouldin Island and Holland Tract and, prior to project operations, transfer a non-assignable conservation easement interest in such lands to the DFG, by instruments substantially similar to the form of the conservation easements in Attachment 5 of this CESA Biological Opinion and mutually agreeable to Delta Wetlands and the DFG. It is the agreement and intention of the parties that Delta Wetlands shall under all circumstances, consistent with the requirements of this CESA Biological Opinion, have full management responsibility for HM lands and that the conservation easement conveyed with respect to such lands are in the nature of a restrictive covenant as authorized by section 815.1 of the California Civil Code.
  - 3.3 With respect to any interest in real property transferred to the Department, all title documentation shall be approved as to form prior to acceptance by either the Fish and Game Commission or the DFG acting through the Wildlife Conservation Board. No approval shall be final until the lands or interests are

accepted as to form by the Department of General Services, but, to the extent allowed by law, any delay in processing or acceptance by any state agency shall not give rise to or contribute to any breach by Delta Wetlands.

- 3.4 Delta Wetlands shall prohibit widespread use of rodenticide on all HM lands and Project lands. Squirrel and rodent control efforts shall be focused only in localized areas where needed to avoid public health problems (e.g., bubonic plague transmission in high-use recreation areas) or to prevent damage to building foundations, roadways, exterior levees, and other facilities. Control efforts shall emphasize non-toxic means (e.g., trapping); where localized rodenticide use is required, the poison least toxic to nontarget organisms shall be selected. All rodenticide use shall be conducted under the county permit system and all actual use shall be reported to the DFG on a quarterly basis. To the extent reasonably allowed under the circumstances, Delta Wetlands shall provide advance notice to the DFG of any use by Delta Wetlands of rodenticide on HM lands.
- 3.5 If, in the judgement of the Director of the DFG, the Plan or plan revisions, or a portion of the Plan or plan revisions, would result in adverse effects to the Swainson's hawk or greater sandhill crane not contemplated by the Biological Opinion, such Plan or plan revisions, or portion thereof, shall not be implemented without the approval of the DFG. If the Plan or plan revisions identify management measures that are inconsistent with management measures required by this CESA Biological Opinion, or conservation easements previously attached to HM lands and Project Lands, Delta Wetlands and the DFG may agree upon revisions or amendments to such instruments, and any revision or amendment to a conservation easement shall be recorded in the same manner as the conservation easement.
- 3.6 For the life of the Project, Delta Wetlands shall provide annually to the DFG upon issuance of the water right permit, the sum of SEVENTY-FIVE THOUSAND DOLLARS (\$75,000.00) in January 1998 dollars adjusted for inflation as specified in this CESA Biological Opinion. Payments shall be made thereafter on or before July 1 of each subsequent year as a permanent support fund ("fund") which will be used by the DFG to monitor Delta Wetlands' management of the HM lands and Project Lands acquired and managed in accordance with this CESA Biological Opinion. A more detailed budget breakdown and explanation of the activities to be performed by the DFG are included in this Biological Opinion (Attachment 6).

4.0 **Aquatic Habitat Development Measures:** This measure is necessary to minimize the adverse impacts of take of delta smelt.

Delta Wetlands shall mitigate impacts on shallow shoal habitat in the delta smelt's rearing areas to offset impacts of moving X2 upstream in the February through June period. Funds in the Aquatic Habitat Restoration Fund (RPM 2.0) shall be used to restore and maintain at least 100 acres of shallow shoal/low elevation tidal wetland in the eastern Suisun Marsh and Bay or western Delta. The habitat acquired with Aquatic Habitat Restoration Fund money may be purchased from a mitigation bank or acquired and managed in an alternative ownership and management arrangement acceptable to DFG. DFG may not take fee title to such mitigation habitat.

- 5.0 HMP Prerequisite for Project Operation:** This measure is necessary to minimize the adverse impacts of take of Swainson's hawk and greater sandhill crane.

In no case shall water be stored on Project Lands for purposes other than wetland habitat management prior to completion of the initial habitat island construction called for in the HMP. Furthermore, in no case shall water be stored on Project Lands for purposes other than wetland habitat management if the actions called for in the HMP are not being implemented.

- 6.0 Aquatic Species Monitoring:** This measure is necessary to minimize the adverse impacts of take of winter-run and delta smelt.

- 6.1** All field sampling activity shall be performed in accordance with terms and conditions of appropriate DFG Scientific Collection Permits issued to personnel participating in project monitoring.
- 6.2** Monitoring programs shall be developed by the USFWS, NMFS, DFG, and Delta Wetlands as set forth in the Final Operations Criteria and Fish Monitoring Program dated January 27, 1997 (Attachment 2).
- 6.3** The designated representative of the DFG shall be notified within 24 hours *via* telephone, e-mail, and/or fax in the event that one (1) winter-run chinook salmon smolt (identified by daily size intervals), delta smelt, or splittail is collected during monitoring. Until further notice, the designated representative of the DFG is Mr. Frank Wernette with the Bay-Delta and Special Water Projects Division. Mr. Wernette may be reached by telephone at (209) 948-7800, e-mail [fwernett@delta.dfg.ca.gov](mailto:fwernett@delta.dfg.ca.gov), and by facsimile at (209) 946-6355. Mr. Wernette's mailing address is 4001 N. Wilson Way, Stockton, CA 95205.
- 6.4** A weekly status report, presenting preliminary results of field fisheries collections and experimental investigations shall be prepared and distributed to all designated agency representatives throughout the duration of the field sampling program.

6.5 DFG personnel shall be permitted to observe all field and lab investigations associated with any monitoring project. All scientific data collected as part of the real time monitoring shall be provided, upon request, for independent review and analysis by the DFG.

**7.0 Management Measures and Monitoring of Greater Sandhill Cranes and Swainson's Hawks:** This measure is necessary to minimize the adverse impacts of take of Swainson's hawk and greater sandhill crane.

7.1 Monitoring of greater sandhill cranes and Swainson's hawks shall be conducted beginning prior to initial construction of the Habitat Management lands on Bouldin Island and Holland Tract and annually for five years after initial habitat island construction is completed. A specific monitoring plan shall be developed for these species consistent with the provisions of the HMP. If any inconsistencies between the following measures and the HMP exist, then the HMP shall control. Features of the plan shall include but not be limited to:

- Monitoring during September through March for greater sandhill cranes and March through September for the Swainson's hawk
- Numbers of birds seen
- Activity/behavior
- Habitat being used
- Mapping of roosting areas or nesting sites

7.2 To prevent disruption by Project construction and maintenance and reduce the potential for adverse impacts to Swainson's hawks during the breeding season, Delta Wetlands shall complete pre-construction and pre-maintenance surveys of potential nest trees within one-half mile of any propose work site.

7.3 Results of preconstruction surveys shall be submitted to the DFG within two weeks of their completion. A letter report and map addressing essential information (e.g., number of Swainson's hawks located in the Project area, their status, other identified activities) also shall be submitted. If no activity is identified during preconstruction surveys, a brief letter documenting this fact shall be submitted to the DFG.

7.4 Delta Wetlands shall prohibit widespread use of rodenticide on all HM lands and

all Delta Wetlands Project lands. Rodent control efforts shall be focused only in localized areas where needed to prevent damage to exterior levees. Control efforts shall emphasize non-toxic means (e.g., trapping): where localized rodenticide use is required, the poison least toxic to nontarget organisms shall be selected. All rodenticide use shall be conducted under the count, permit system and all actual use shall be reported to the DFG on a quarterly basis. To the extent reasonably allowed under the circumstances Delta Wetlands shall provide advance notice to the DFG of the use of rodenticide on HM lands.

7.5 Environmental monitors shall be on-site regularly during construction to monitor mitigation implementation. Environmental monitors shall regularly check to ensure that mitigation measures are being adhered to and that exclusion zones and fences are operative. The supervisor shall immediately contact the on-site biologist or environmental monitor regarding any incidents of non-compliance, who shall notify the DFG within 24 hours, followed by written notification within 3 working days, of any such incident.

7.6 In addition to described preconstruction and construction mitigation measures, Delta Wetlands Project shall implement guidelines adopted in its conceptual recreation plan to avoid impacts on listed species from recreational use and facility construction. These measures include the following: conduct preconstruction surveys of potential and occupied habitat and undertake appropriate precautions during facility construction as outlined above, avoid constructing recreation facilities and trails within a 0.5 mile radius of an active Swainson's hawk nest.

## 8.0 Listed Plants:

In the event listed plants are found on the project islands the following measures shall be implemented prior to and during any future construction activities. If the construction is considered by the DFG to be minor, the DFG may waive the requirements of this RPM. If any inconsistencies between the following measures and the HMP exist, then the HMP shall control.

8.1 Floristic studies of the areas likely to be affected by the project shall be conducted according to the DFG's guidelines. These studies shall be carried out in the spring and summer when any rare plant species that may be present are likely to be evident and identifiable (see guidelines 4a and 4b). The Suisun Marsh aster, Rose mallow and Mason's lilaeopsis are often not identifiable before June.

8.2 If listed plant species are found on the project site, redesigning the project to

avoid or minimize the impacts on these species shall be attempted. If impacts are unavoidable, a mitigation and monitoring plan which follows the enclosed format shall be developed. Mitigation options may involve restoring the rare plant population and associated habitat on- or off-site and providing for the long-term protection of the mitigation site.

- 8.3** All levee projects must be preceded by preparation and adoption of specific plans detailing the project impacts, mitigation and compensation measures that will reduce project impacts to result in no net loss of riparian, fishery, or wildlife habitat as per Sections 8610 and 8611 of the State Water Code. Monitoring plans to evaluate mitigation/compensation must be prepared and shall include remedial actions necessary if success criteria are not achieved. Annual reports shall be provided to the DFG.
- 9.0 Yellow-billed Cuckoo:** This measure is necessary to minimize the adverse impacts of take of yellow-billed cuckoo, at such time as the yellow-billed cuckoo may be discovered on the project islands. The following measures shall be implemented prior to and during any future construction activities. If the construction is considered by the DFG to be minor, the DFG may waive the requirements of this RPM.
- 9.1** Tape recorded yellow-billed cuckoo (YBC) calls that successfully elicit vocalization by the YBC shall be used to survey construction sites and a 200 meter buffer prior to and during the nesting and rearing period of the YBC from June 1 - August 15. A minimum of 15 minutes of effort shall occur at each survey station. Survey stations shall not be located greater than 100 meters apart. Surveys shall be conducted twice weekly between 0700 and 1000 hours, at least 3 days apart, prior to any construction activities scheduled between June 1 and August 15. All surveys should extend 200 meters beyond the distal portions of the project site.
- 9.2** If survey results are positive, construction shall be avoided within 200 meters of nests, if located, or within 200 meters of survey stations where positive results were obtained until after August 15.
- 9.3** No construction is allowed between June 1 and July 20 in riparian areas exceeding 90 meters in width.
- 9.4** The DFG will concur with negative survey results under the following conditions:
- 9.4.1** At least 2 weeks of negative results from June 7 through 21 at dense riparian sites of 15 to 30 meters in width.

9.4.2 Riparian sites exceeding 30 meters, but less than 90 meters in width shall require negative results during the three survey weeks immediately preceding any construction proposed between July 1 and August 15.

9.4.3 Riparian areas exceeding 90 meters in width shall be surveyed weekly between June 7 and July 20. Construction scheduled after July 20 may proceed if all survey results are negative.

9.4.4 Sparse riparian areas less than 30 meters in width do not require surveys unless they are located within 200 meters of dense riparian habitat exceeding 30 meters in width.

**10.0 Giant Garter Snake:** This measure is necessary to minimize the adverse impacts of take of giant garter snake, at such time as the giant garter snake may be discovered on the project islands. The following measures shall be implemented prior to and during any future construction activities. If the construction is considered by the DFG to be minor, the DFG may waive the requirements of this RPM. During routine operation and maintenance activities the DFG may prescribe these measures unless the DFG concludes that those activities are minor and unlikely to affect the giant garter snake.

**10.1** Localized construction and related impacts needed to reroute drainwater should be conducted in a manner that avoids take of any giant garter snakes present within the construction footprint. To avoid such take, all construction within suitable habitat should be conducted during the snake's active season (May 1 to October 1) rather than during the snake's winter dormancy period (October 1 to May 1) when giant garter snakes are wary and highly vagile during the active phase of their life cycle and able to move away from the localized disturbance of the construction sites, physical alterations should be scheduled during this time period. The small amount of temporary habitat disturbance is not expected to result in significant impacts provided these conservation measures are adopted.

**10.2** The many procedures for maintaining the canals and ditches are, for the most part, compatible with GGS. Certain maintenance practices, are, however, detrimental to the GGS and its habitat and shall be avoided. The detrimental practices are: 1) lining the canals with cement or gunite and 2) excavating canals during the GGS dormant season (October 1-May 1). Spraying or otherwise removing the vegetation from the banks of the canals should be minimized.

**10.3** Adverse impacts to the GGS during maintenance operations can be lessened by adhering to the HMP and to the following guidelines:

**10.3.1** Excavate from only one side of the canal during a given year. Avoid

excavating the banks above the high water level. Sides of any canals dedicated as emergent wetland habitats, shall be left undisturbed indefinitely.

**10.3.2** Excavate the canals during the GGS active season. This is approximately May 1 to October 1.

**10.3.3** Leave the vegetation on the tops and sides of the canals undisturbed.

**10.3.4** Restrict auto traffic along the canals to maintenance or other official vehicles.

**10.4 Other construction related avoidance measures include:**

**10.4.1** No grading, excavating, or filling may take place in or within 30 feet of existing GGS habitat from October 1 and May 1 unless authorized by the DFG.

**10.4.2** Construction of replacement habitat may take place at any time of the year, but summer is preferred.

**10.4.3** Dewatering of the existing habitat may begin any time after November 1, but must begin by April 1. All water must be removed from the existing habitat by April 15, or as soon after as weather permits, and the habitat must remain dry (no standing water) for 15 consecutive days after April 15 and prior to excavating or filling the dewatered habitat.

**10.4.4** Any GGS surveys required by the DFG shall be completed to the satisfaction of the DFG prior to dewatering.

**10.4.5** The DFG shall be notified when dewatering begins and when it is completed. The DFG will inspect the area to determine when the 15-day dry period may start. The DFG contact for inspection shall be Mr. Frank Wernette or his designee at (209) 948-7800, unless the DFG makes other arrangements.

**11.0 Black Rail:** This measure is necessary to minimize the adverse impacts of take of black rail, at such time as the of black rail may be discovered on the project islands. The following measures shall be implemented prior to and during any future construction activities. If the construction is considered by the DFG to be minor, the DFG may waive the requirements of this RPM.

**11.1** Tidally influenced shoreline margins with bands of tules, cattails, phragmites, or pickled exceeding 3 meters in width must be surveyed using tape-recorded calls during the black rail breeding season (March 1 to June 30). Surveys shall be

conducted between sunrise and 1000 hours. Recorded calls must be played three times at each station with 5 minute intervals for monitoring of responses. Calling stations shall not be further than 100 meters apart. Two surveys, separated by at least 2 days shall be conducted per week. The DFG will concur with negative results if a minimum of two survey weeks (4 surveys) with negative results are performed immediately prior to construction between March 15 and June 1. Negative survey results after June 1 or before March 1 are unacceptable.

**11.2** No construction shall occur within 200 meters of survey stations where positive results were obtained between the period of March 15 and June 30 or until approved by the DFG. Compensation for habitat lost due to project impacts shall entail recreation of shoreline habitat or berm islands at sites acceptable to the DFG. Compensation shall occur at a 3 to 1 ratio for each site impacted by the project. This ratio is required to compensate for the time-lag required for restored habitats to mature.

**11.3** The DFG is to be notified in writing within three working days of the finding of any dead or injured threatened or endangered species during construction, operation, or maintenance of the proposed facilities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal, and any other pertinent information. The DFG contact for this information is the Bay-Delta and Special Water Projects Division at (209) 948-7800. Any endangered species found dead or injured must be turned over to the DFG for care or analysis.

**12.0 Fish Screens:** This measure is necessary to minimize the adverse impacts of take of winter-run chinook salmon and delta smelt.

Fish screens installed on existing and new diversions shall comply with the DFG's fish screen policy. A "Fish Screen Test Plan" and a "Fish Screen Maintenance Plan" shall be developed by Delta Wetlands as set forth in the Final Operating Criteria. Final plans shall be completed after the project is permitted and must be accepted, in writing, by the DFG.

**13.0 DFG notification and approval:**

Wherever the federal biological opinions require that the Corps, Board, or Delta Wetlands inform, notify, or obtain the approval of the USFWS or NMFS, the Corps, Board, or Delta Wetlands shall also inform, notify, or obtain the approval of the DFG, if the information, notification, or approval concerns the Listed Species. Where the DFG's approval is required, the DFG shall comply with the schedule or time constraints described in this

Biological Opinion.

**14.0 Project representative:**

At least thirty (30) days before initiating ground-disturbing activities, the Board, shall designate a representative responsible for communications with the DFG and for overseeing compliance with this Biological Opinion. The DFG shall be informed, in writing, of the representative's name, business address and telephone number, and shall be notified in writing if a substitute representative is designated.

**15.0 Employee orientation:**

The Board or its designee shall conduct an orientation program for all persons who will regularly work on-site during construction. The program shall consist of a brief presentation from a person knowledgeable about the biology of the Listed Species, the terms of this Biological Opinion, and of CESA. The education program shall include a discussion of the biology of the Listed Species, the habitat needs of these species, their status under CESA, and the Conservation Measures in this Biological Opinion. A fact sheet containing this information shall also be prepared and distributed. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all Conservation Measures. These forms shall be filed at the Board's office and shall be accessible by the DFG.

**16.0 Notification regarding dead, injured or entrapped animals:**

If Delta Wetlands, its employees, contractors or agents kill or injure an individual of a Listed Species, or finds any such animal dead, injured, or entrapped, Delta Wetlands shall immediately notify the DFG. All reasonable efforts shall be made to allow any entrapped animals to escape. Any dead or injured animal shall be turned over to the DFG and a written report detailing the date, time, location and general description of the circumstances under which it was found must be submitted to the DFG no later than three business days following the incident.

**17.0 Construction compliance inspections and reports:**

During construction, compliance inspections shall be completed once a week and Delta Wetlands shall provide a monthly compliance report to the DFG. The inspections shall assess compliance with all RPMs in this Biological Opinion, specifically including the creation and maintenance of exclusion zones. Within forty-five (45) days of completing the Project, the Board shall provide to the DFG a final, post-construction compliance report. The report shall be prepared by a biologist knowledgeable of the biology of the

Listed Species and shall include the following: 1) construction dates; 2) verification that all RPMs were fully implemented; 3) identification of RPMs, if any, that were not fully implemented; 4) description of effects on Listed Species and Listed Species habitat; 5) any other pertinent information.

**18.0 Access to Project site:**

Delta Wetlands shall allow DFG representatives access to the Project site for purposes of monitoring compliance with the provisions of this Biological Opinion. The DFG will observe any reasonable access restrictions requested by the Board and Delta Wetlands.

**19.0 Incidental Entrainment Compensation:** This measure is necessary to minimize the adverse impacts of take of delta smelt.

In lieu of monitoring for the entrainment of eggs, larvae, and fry as described in Measure 7 on pages 14 and 15 of the Final Operating Criteria (Attachment 2), Delta Wetlands will provide \$1.00 per acre foot of water diverted to storage during the specified period. All other provisions of Measure 7 shall apply. Funds derived from this RPM shall be provided to the DFG semi annually in any year the Project diverts to storage. Funds shall be provided on or before April 30 for the period January through March and on or before September 30 for the period June through August in any year in which compensation is required. In the event that the federal fish and wildlife agencies do not agree to waive sampling, the Incidental Entrainment Compensation provisions in the FOC shall remain as currently drafted and this RPM will not be imposed.

**20.0 Aquatic Habitat Restoration Fund:** This measure is necessary to minimize the adverse impacts of take of winter-run and delta smelt.

**20.1** An "Aquatic Habitat Restoration Fund" shall be established by Delta Wetlands. This fund shall exclusively benefit and be controlled by the DFG. At the DFG's discretion, this fund may be used for environmental enhancement opportunities that benefit winter-run and delta smelt.

**20.2** Delta Wetlands shall provide an initial installment of \$700,000 for the "Aquatic Habitat Restoration Fund". That installment shall be provided to the DFG prior to the commencement of diversions to storage. This fund is intended to supplement funds received from other provisions in the Final Operating Criteria (Attachment 2) including Measure 3, Boat Wake Erosion on page 12; and, Measure 7, Incidental Entrainment Compensation on pages 14 and 15. The habitat acquired with Aquatic Habitat Restoration Fund money may be purchased from a mitigation bank or acquired and managed in an alternative ownership and management arrangement acceptable to DFG. DFG may not take fee title to such mitigation habitat.

## **X. IMPACTS OF THE PROPOSED PROJECT UNDER THE CESA BIOLOGICAL OPINION**

Following is a description of the basis for the DFG's Biological Opinion and the rationale for the DFG'S Reasonable and Prudent Measures. It describes the effects of the proposed Delta Wetlands Project on listed fish species with implementation of the Reasonable and Prudent Measures contained in the CESA Biological Opinion.

### **A. OVERVIEW OF SIMULATED DELTA WETLANDS PROJECT OPERATIONS UNDER THE CESA BIOLOGICAL OPINION**

The impacts of the project consistent with the Reasonable and Prudent Measures in the DFG's Biological Opinion is described below. The biological rationale for the Reasonable and Prudent Measures is also provided. The DFG used output from the model run completed by JSA for a suite of measures recommended by the DFG. Since the scope of measures has been reduced to only those that are included as RPMs in this Biological Opinion these data were interpreted carefully to estimate the reductions in take.

The RPMs will result in average annual Delta Wetlands diversions of approximately 191 TAF and average annual Delta Wetlands discharges to export of 153 TAF. The RPMs will also increase flows under certain hydraulic conditions through the release of water stored as environmental water pursuant to the Final Operating Criteria and as a result of flows acquired and released using funds in the Environmental Water Fund.

RPM 1.0 reduces project diversions by approximately 1 percent or 1 TAF.

The project operated as allowed by the CESA Biological Opinion RPMs will reduce the adverse impacts of the Delta Wetlands Project that remained under the federal biological opinions. Relative to conditions under the No-Project Alternative, operations under the RPMs will reduce the maximum monthly upstream shift of X2 in February through June. The remaining shift is offset by developing 100 acres of shallow water habitat.

### **B. ASSESSMENT OF NET PROJECT IMPACTS AND BENEFITS UNDER THE RPMS**

A broad array of actions will help to contribute to reducing the adverse effects of take associated with the project and providing some aquatic improvements:

- Improvement in positive westerly flows (QWEST) in the February to April period to a level better than the No-Project condition in some years.
- Decrease in adverse flows toward the central and south Delta (CDFP) in March

through June from No-Project levels.

The CESA Biological Opinion provides more uniform protection even when FMWT indices are >239 and monitoring does not indicate delta smelt are present. This is of critical importance to providing adequate protection for both species, particularly winter-run chinook salmon. Based on the FMWT indices reported since 1967, less than 25 percent of the years would be affected by the index sensitive measures. Therefore, the additional protection offered when the FMWT is <239 would only be provided in 1 of 5 years.

### **C. GENERAL IMPACTS**

Most of the impacts associated with the project as allowed by the federal biological opinions will remain. In the CESA Biological Opinion, however, the impacts of losses associated with increased entrainment due to project diversions and export of project discharges will be reduced by using the maximum rate at which funds are collected without the need for monitoring. Habitat developed with these funds will contribute to improving aquatic habitat conditions for the listed fish in the Delta.

### **D. OPERATIONAL IMPACTS**

The CESA Biological Opinion will have a very small impact on Delta Wetlands operations. Project yield associated with the CESA Biological Opinion will be essentially as predicted for the project operated under the Final Operating Criteria.

### **E. FLOW AND HYDRODYNAMIC IMPACTS**

#### **1. WINTER- AND SPRING-RUN CHINOOK SALMON**

Changes in Delta hydrodynamics resulting from project diversions during the critical rearing and migration period for juvenile winter-run chinook salmon is expected to be reduced. Diversions in March will be reduced under adverse negative QWEST conditions. Releases of environmental water associated with the Final Operating Criteria or purchased by the DFG using the Environmental Water Fund and released are likely to contribute to reducing the adverse effects of take of rearing and emigrating juvenile salmon. Existing reverse flows conditions in the lower San Joaquin River, Old River, and Middle River could be improved in drier conditions.

#### **2. DELTA SMELT**

Changes in Delta hydrodynamics resulting from project diversions during the period will be reduced under the CESA Biological Opinion. Many of the benefits described above will also apply to delta smelt. The uniform intake criteria in March will reduce the adverse effects on

channel hydraulics in the vicinity of the intakes. This may reduce the likelihood of increased entrainment of larval and small juveniles into the diversions.

## **F. ENTRAINMENT**

With the CESA Biological Opinion, project operations will be modified and the entrainment of winter-run and delta smelt will be reduced compared to existing conditions.

## **G. ECONOMIC FEASIBILITY**

Reductions in project yield associated with the CESA Biological Opinion will have no significant affect on project feasibility. This is particularly true since effects on yield associated with the Final Operating Criteria are likely to be over-estimates since project yield can increase as storage capacity increases over time and because models used to estimated impacts were monthly models that could not take into account operational opportunities that were on a less than monthly basis. In addition, if the project is sold to the CVP or SWP, during reconsultation, opportunities could be explored to coordinate operations with the CVP and SWP which could increase yield while preserving environmental protection.

## **XI. BIOLOGICAL BASIS FOR THE REASONABLE AND PRUDENT MEASURES**

Below, the DFG presents its biological basis for four of the Reasonable and Prudent Measures.

### **A. RPM 1.0: MARCH RESTRICTIONS**

This measure reduces impacts on the critical rearing and migration period for juvenile winter-run. It will help reduce impacts during a critical spawning and rearing period for delta smelt and reduce impacts during times when the most vulnerable life stages of delta smelt are present. This measure minimizes the decreases in Delta outflow, increases in export/inflow levels, and reductions in QWEST that are likely to reduce the survival of rearing and emigrating juvenile fish.

This RPM reduces increased diversions and the associated fishery impacts during the peak month for winter-run chinook salmon (March) when nearly 50 percent of the year's production can be located in the Delta and vulnerable to project impacts. This RPM avoids the problem associated with the federal biological opinions of not providing adequate fishery protection in 4 out of 5 years because the FMWT index for delta smelt is >239.

March is also a critical months for delta smelt. Adults are entering the Delta for spawning

and larval smelt are present in significant numbers. Twenty-five percent of the total population of delta smelt larvae are present in the Delta during March.

## RESIDUAL IMPACTS

Adverse impacts associated with Delta Wetlands diversions and discharges may remain in the November through May period for winter-run juveniles, in the December through June period for adult delta smelt, and February through August period for juvenile delta smelt. Larval and juvenile delta smelt are flushed into eastern Suisun Bay by the end of August and removed from the most direct influence of the Delta Wetlands Project. Project operations will still result in negative impacts on QWEST in the November through February period. Therefore, unavoidable impacts on delta smelt and winter-run may remain. RPMs 2.0 and 20.0 will address those residual impacts.

### B. RPM 2.0: ENVIRONMENTAL WATER FUND

Establishing an Environmental Water Fund and contributing funds based on five percent of the project diversions that occur in the October through March period is a key measure of the CESA Biological Opinion to minimize the adverse impacts of incidental taking and interacts with other protective measures in the CESA Biological Opinion and federal biological opinions so that the environmental baseline is not severely degraded by the Delta Wetlands Project. Requiring an initial deposit of \$300,000 will help fund initial water acquisitions or environmental enhancement opportunities that will benefit winter-run and delta smelt.

The improvements resulting from controlled releases of water in the March through May period will reduce the level of take of listed species associated with water exports and increase survival sufficiently above current conditions to help offset unavoidable impacts associated with take during other months. Failure to include this measure will result in unacceptably high levels of take, in the serious degradation of the environmental baseline, and will be inconsistent with the Delta Accord.

Since significant adverse effects would remain for delta smelt and winter-run under the federal biological opinions, even with RPM 1.0 of the CESA Biological Opinion, maintaining the environmental baseline has been the DFG's position and is supported by the environmental community and sport fishing groups. This RPM allows resource agencies the ability to release a portion of the water back to the environment during critical periods to offset unavoidable losses at other times. While the amount dedicated with this project is not large in some years, in the DFG's opinion it is sufficient, in conjunction with the other RPMs, to minimize the adverse impacts of incidental taking pursuant to Section 2091.

In developing this RPM, the DFG based its rationale on a review of the project from the standpoint of the estimated water budget for the habitat islands displayed in Table A1-8 of

Appendix A in the DEIR/EIS. With that water budget, the DFG estimates that average annual funding for the Environmental Water Fund will range from approximately \$200,000 to \$300,000 in January 1998 dollars. These funds may be used to acquire water from water rights holders on tributaries to the Sacramento or San Joaquin rivers. Release of that water as specified by the DFG could provide significantly higher benefits to aquatic resources in the Delta compared to releases from the Delta Wetlands project islands. If the estimated water budget in the DEIR/EIS significantly underestimates actual discharges from the habitat islands, the amount credited against the Environmental Water Fund will be excessive and the expected benefit from this RPM may be degraded. The DFG may be required to reinitiate consultation depending on the extent of the difference between the information provided in the DEIR/EIS and actual operational experience following project implementation if the difference results in a significant additional adverse impact and significant degradation of this RPM to minimize the adverse impacts of take of winter-run and delta smelt.

### **C. RPM 4.0: AQUATIC HABITAT DEVELOPMENT MEASURES**

When the mixing zone is located in Suisun Bay where there is extensive shallow water habitat within the euphotic zone (depths less than four meters), high densities of phytoplankton and zooplankton may accumulate (Arthur and Ball 1978, 1979, 1980) upon which juvenile delta smelt feed. The area immediately upstream of X2 is referred to as the "entrapment" zone, and concentrates nutrients and the food microorganisms upon which "rearing" delta smelt feed. Project operation is predicted to cause upstream shifts in X2. This shift will reduce the amount of suitable salinity habitat in the Suisun Bay area. The DFG finds that the acquisition, restoration, and management of 100 acres of shallow shoal/low elevation tidal wetland habitat will offset the adverse effects of this shift.

The federal biological opinions provide for offsetting this impact by securing an easement on 200 acres of shallow water aquatic habitat in the Delta. This may result in no new habitat being restored but simply an easement being provided on existing habitat. The net loss of habitat would remain.

Project construction activities such as the installation of siphons and pumps will impact water side habitat. Impacts have been estimated at 50 acres. Actual impacts should be measured during construction and mitigated using a 3:1 replacement ratio.

### **RESIDUAL IMPACT**

In some years impacts on rearing habitat may be greater than the modeling suggests and the mitigation acreage defined in the RPM may not fully offset those impacts.

## **D. RPM 20.0: AQUATIC HABITAT RESTORATION FUND**

Establishment of an "Aquatic Habitat Restoration Fund" and requiring an initial deposit of \$700,000 will help fund environmental enhancement opportunities to benefit winter-run and delta smelt. This fund will be used to restore the 100 acres of aquatic habitat that is targeted to compensate impacts associated with Project induced upstream shifts in X2.

Money provided from Measure 3, Boat Wake Erosion on page 12 of the FOC and Incidental Entrainment Compensation on pages 14 and 15 of the FOC will also be deposited into this fund. Combining these funds will contribute to more efficient efforts to restore aquatic resources in the Bay-Delta. Collectively, these funds will be used to support projects that will increase survival of winter-run and delta smelt above base line levels to help offset unavoidable impacts associated with take caused by the project.

## **XII. SCOPE OF AUTHORIZATION**

The RPMs described in the Biological Opinion are non-discretionary and the Board must, as a binding condition of Delta Wetlands' Water Right permit, require the Delta Wetlands Project to comply with the requirements of the RPMs in order for the take authorization in Section 2091 to apply. The Board has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Board fails to: (1) require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document; and/or (2) retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 2091 may lapse.

## **XIII. ADDITIONAL CONSERVATION RECOMMENDATIONS**

Under CESA, it is incumbent on all State agencies to seek to conserve endangered and threatened species. The following recommendations, while not required pursuant to Fish & Game Code §§2090-2092, are offered as additional conservation recommendations to be implemented by the SWRCB in furtherance of the purposes of CESA. The following recommendations have been made as more detailed CEQA mitigation recommendations during the water rights hearing. The biological basis for these recommendations were also provided in the water rights hearing.

### **A. FOOD HABITS ANALYSIS**

The Board should encourage the Delta Wetlands Project to complete a food habits analysis of salmon caught during required sampling activities in order to better assess temperature effects on rearing and migrating juvenile salmon in the Delta.

## B. WATER QUALITY

Delta Wetlands should operate in a manner which will ensure that discharges associated with the Delta Wetlands Project do not result in significant impacts on Listed Species in the Delta. Delta Wetlands should develop and implement a final monitoring program, in consultation with the DFG, which is accepted, in writing, by the DFG, USFWS, and NMFS prior to Delta Wetlands commencing operations.

## C. RECOMMENDATIONS TO REDUCE IMPACTS IN PROJECT SERVICE AREAS

In order to minimize the incidental take of State listed species in the service areas receiving water from the Delta Wetlands Project, Delta Wetlands should annually provide the DFG with funds on the following schedule: Fifty cents per acre foot in those water years when Delta Wetlands exports between 25 and 50 thousand acre-feet of water; 75 cents per acre foot in those water years when Delta Wetlands exports are 50 to 100 thousand acre-feet of water; and, one dollar per acre foot in those water years when Delta Wetlands exports over 100 thousand acre-feet of water. All funds should be in Jan. 1997 dollars, adjusted for inflation as specified in this CESA Biological Opinion, and provided to the DFG by Jan. 1 following the subject water year in which the exports occurred. The DFG will deposit such funds in a special deposit account pursuant to Government Code Section 16370 for actions to mitigate impacts to Listed Species such as implementing Habitat Conservation Plans (HCP) pursuant to Section 10 of the Federal Endangered Species Act (FESA), Natural Community Conservation Plans (NCCP) pursuant to Fish and Game Code 2800, or other comprehensive area plans, approved by the USFWS and/or the DFG and purchasing of core conservation areas identified in those plans. This provision satisfies that portion of the Project's responsibility to address service area impacts. Obligations of project proponents whose projects induce or cause adverse land use changes in the service area will be addressed in Project specific consultations or through the mechanisms outlined in the applicable HCPs or NCCPs. The species covered by this recommendation shall be limited to those species identified for the service areas described in Attachment 4.

## D. SPECIAL STATUS PLANTS

For special status plants that are not listed under CESA the following measures should be taken.

1. Floristic studies of the areas likely to be affected by the project should be conducted according to the DFG's guidelines. These studies should be carried out in the spring and summer when any rare plant species that may be present are likely to be evident and identifiable (see guidelines 4a and 4b). The Suisun Marsh aster, Rose mallow and Mason's lilaeopsis are often not identifiable

before June.

2. If listed plant species are found on the project site, redesigning the project to avoid or minimize the impacts on these species should be attempted. If impacts are unavoidable, a mitigation and monitoring plan which follows the enclosed format should be developed. Mitigation options may involve restoring the rare plant population and associated habitat on- or off-site and providing for the long-term protection of the mitigation site.
3. All levee projects should be preceded by preparation and adoption of specific plans detailing the project impacts, mitigation and compensation measures that will reduce project impacts to result in no net loss of riparian, fishery, or wildlife habitat as per Sections 8610 and 8611 of the State Water Code. Monitoring plans to evaluate mitigation/compensation should be prepared and should include remedial actions necessary if success criteria are not achieved. Annual reports should be provided to the DFG.

### E. DIVERSION RECOMMENDATIONS

The Board should take actions that reduce adverse effects of diversions on Delta hydrodynamics in June and July, during periods of low San Joaquin River inflow as measured at Vernalis, and during the pulse flow period when flows in Middle and Old rivers are favorable for aquatic resources.

### XIV. FUTURE CONSULTATION

Pursuant to Fish and Game Code §2090, if the RPMs identified in this Biological Opinion are not fully implemented and adhered to, or if the Project is substantially modified, further consultation with the DFG is required.

Re-initiation of formal consultation is required if: 1) the amount or extent of taking specified in any incidental take statement is exceeded; 2) new information reveals effects of the action that may affect listed species or habitat in a manner or to an extent not previously considered; 3) the action is subsequently modified in a manner that causes an effect to the listed species or its habitat that was not considered in the biological opinion; 4) there is a significant project modification; or 5) a new species is listed that may be affected by the action.

If the spring-run chinook salmon is ultimately listed by the California Fish and Game Commission, the Board, Delta Wetlands, or the current owner of the Project shall, pursuant to Section 2090 or in its absence 2081, initiate consultation with the DFG with regards to the spring-run chinook salmon.

## XV. NOTICES

Notices and other communications regarding this Biological Opinion will be addressed as follows. Any funds provided to the DFG as a condition of the RPMs in this Biological Opinion shall be submitted to the DFG at the address below:

DFG

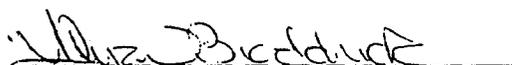
DIVISION CHIEF  
California Department of Fish and Game  
Bay-Delta and Special Water Projects Division  
4001 North Wilson Way  
Stockton, California 95205

DELTA WETLANDS

DELTA WETLANDS  
3697 Mt. Diablo Boulevard, Suite 100  
Lafayette, California 94649

STATE WATER  
RESOURCES CONTROL  
BOARD

CHIEF, WATER RIGHTS DIVISION  
Water Resources Control Board  
901 P Street  
Sacramento, California 95814

  
L. Ryan Broddrick, Chief Deputy Director  
Department of Fish and Game

Date: AUGUST 7, 1998

## XVI. ATTACHMENTS

ATTACHMENT 1: FEDERAL BIOLOGICAL OPINIONS

ATTACHMENT 2: FINAL OPERATIONS CRITERIA AND FISH MONITORING PROGRAM - JANUARY 27, 1997.

ATTACHMENT 3: TERRESTRIAL RESOURCES HABITAT MANAGEMENT PLAN (HMP)

ATTACHMENT 4: LIFE HISTORY OF STATE LISTED SPECIES; AND APPENDIX:

1. APPENDIX A - LISTED SPECIES IN THE PROJECT SERVICE AREAS

ATTACHMENT 5: CONSERVATION EASEMENTS

1. APPENDIX A- FORM OF CONSERVATION EASEMENT FOR HM LANDS ON BOULDIN ISLAND.
2. APPENDIX B- FORM OF CONSERVATION EASEMENT FOR HM LANDS ON HOLLAND TRACT.

ATTACHMENT 6: MISCELLANEOUS DATA AND INFORMATION FOR THE DELTA WETLANDS PROJECT BIOLOGICAL OPINION

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**ATTACHMENT 1**

**FEDERAL BIOLOGICAL OPINIONS**

Attachment 1 of the California Endangered Species Act biological opinion is reproduced as Appendices D and E of this REIR/EIS.

**ATTACHMENT 2**

**FINAL OPERATIONS CRITERIA**

**AND**

**FISH MONITORING PROGRAM**

**JANUARY 27, 1997**

Attachment 2 of the California Endangered Species Act biological opinion is reproduced as Appendix B of this REIR/EIS.

**ATTACHMENT 3**

**TERRESTRIAL RESOURCES  
HABITAT MANAGEMENT PLAN**

Attachment 3 of the California Endangered Species Act biological opinion is Appendix G3, "Habitat Management Plan for the Delta Wetlands Habitat Islands", of the 1995 DEIR/EIS.

**ATTACHMENT 4**

**LIFE HISTORY OF  
STATE LISTED SPECIES**

## ATTACHMENT 4

### LIFE HISTORY SUMMARY

Delta Wetlands Inc. proposes to undertake a project that may cause the take of species of wildlife protected by the California Endangered Species Act, California Fish and Game Code §2050, *et seq.* ("CESA").

Life history information concerning the Federal Listed Species is contained in the federal biological opinions. This is a summary life history of the State Listed Species, including those that are federally listed or were previous candidates for listing.

### LISTED SPECIES

Based on an assessment of the Project site and adjacent areas, the DFG has found that 27 of the species listed in Table 4-1 may use the project area, be affected by the Project, or the Project could provide habitat for their reestablishment. These species are the Swainson's hawk, greater sandhill crane, western yellow-billed cuckoo, willow flycatcher, giant garter snake, California black rail, bald eagle, American peregrine falcon, Aleutian Canada goose, loggerhead shrike, Sacramento River winter-run chinook salmon, splittail, delta smelt, Sacramento perch, spring-run chinook salmon, green sturgeon, longfin smelt, and riparian brush rabbit. Other State listed rare and State species of special concern include burrowing owl, tricolored blackbird, riparian wood rat, southwestern pond turtle, northwestern pond turtle, Mason's lilaeopsis, Delta tule pea, Rose mallow, and Suisun aster.

Table 4-1. California Endangered Species Act Biological Opinion for the Delta Wetlands Project-Life History Summary. Listed and Special Status Species.

<u>Species</u>	<u>Status</u>
<u>Fish</u>	
Splittail ( <i>Pogonichthys macrolepidotus</i> )	FPT
Winter-run chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	FE,SE
Spring-run chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	SCT
Delta smelt ( <i>Hypomesus transpacificus</i> )	FT,ST
Longfin smelt ( <i>Spirinchus thaleichthys</i> )	1/
Sacramento perch ( <i>Archoplites interruptus</i> )	1/
Tidewater goby ( <i>Eucyclogobius newberryi</i> )	FE
Green sturgeon ( <i>Acipenser medirostris</i> )	1/
<u>Amphibians</u>	
California red-legged frog ( <i>Rana aurora draytonii</i> )	FT
California tiger salamander ( <i>Ambystoma californiense</i> )	1/
Western spadefoot toad ( <i>Scaphiopus hammondi</i> )	1/
<u>Reptiles</u>	
Giant garter snake ( <i>Thamnophis couchii gigas</i> )	FT,ST
Northwestern pond turtle ( <i>Clemmys marmorata marmorata</i> )	1/
Southwestern pond turtle ( <i>Clemmys marmorata pallida</i> )	1/
San Francisco garter snake ( <i>T. sirtalis tetrataenia</i> )	SE,FE
<u>Birds</u>	
California brown pelican ( <i>Pelecanus occidentalis californicus</i> )	FE,SE
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	FE,SE
American peregrine falcon ( <i>Falco peregrinus anatum</i> )	FE,SE
Aleutian Canada goose ( <i>Branta canadensis leucopareia</i> )	FT
California black rail ( <i>Laterallus jamaicensis coturniculus</i> )	1/,ST
Western snowy plover ( <i>Charadrius alexandrinus nivosus</i> )	FT
California clapper rail ( <i>Rallus longirostris obsoletus</i> )	FE,SE
California least tern ( <i>Sterna anillarum browni</i> )	FE,SE
Tricolored blackbird ( <i>Agelaius tricolor</i> )	1/
Saltmarsh common yellow throat ( <i>Geothlypis trichos sinuosa</i> )	1/
Suisun song sparrow ( <i>Melospiza melodia maxillaris</i> )	1/
San Pablo song sparrow ( <i>Melospiza melodia samuelis</i> )	1/
Swainson's hawk ( <i>Buteo swainsoni</i> )	ST
Greater sandhill crane ( <i>Grus canadensis tabida</i> )	ST
Bank swallow ( <i>Riparia riparia</i> )	ST
Western yellow-billed cuckoo ( <i>Coccyzus americanus occidentalis</i> )	SE,1/
Loggerhead shrike ( <i>Lanius ludovicianus</i> )	1/
Willow Flycatcher ( <i>Empidonax trailii</i> )	SE, 1/
Burrowing owl ( <i>Athene cunicularia</i> )	SSC

## Mammals

Suisun ornate shrew ( <i>Sorex ornatus sinuosus</i> )	1/
Salt marsh harvest mouse ( <i>Reithrodontomys raviventris</i> )	FE,SE
Yuma myotis/bat ( <i>Myotis yumanensis</i> )	1/
Riparian woodrat ( <i>Neotoma fuscipes riparia</i> )	1/
Riparian brush rabbit ( <i>Sylvilagus bachmani riparius</i> )	SE
San Joaquin kit fox ( <i>Vulpes macrotis mutica</i> )	ST,FE
Salt marsh wandering shrew ( <i>Sorex vagrans halicoetes</i> )	1/

## Plants

Rose mallow ( <i>Hibiscus lasiocarpus</i> )	1/
Delta tule pea ( <i>Lathyrus jepsonii</i> var. <i>jepsonii</i> )	1/
Suisun slough thistle ( <i>Cirsium hydrophilum</i> var. <i>hydrophilum</i> )	FE
Suisun aster ( <i>Aster lentus</i> )	1/
Mason's lilaeopsis ( <i>Lilaeopsis masonii</i> )	1/,SR
Soft bird's beak ( <i>Cordylanthus mollis</i> ssp. <i>mollis</i> )	FE, SR
Hispid bird's beak ( <i>Cordylanthus mollis</i> spp. <i>hispidus</i> )	1/
Delta button-celery ( <i>Eryngium racemosum</i> )	SE,1/
Salt marsh bird's beak ( <i>Cordylanthus maritimus</i> ssp. <i>maritimus</i> )	SE,FE
Contra Costa wallflower ( <i>Erysimum capitatum</i> ssp. <i>angustatum</i> )	SE,FE
Antioch Dunes evening-primrose ( <i>Oenothera deltooides</i> spp. <i>howellii</i> )	SE,FE
Pitkin Marsh Indian paintbrush ( <i>Castilleja uliginosa</i> )	SE,1/
Slough thistle ( <i>Cirsium crassicaule</i> )	1/
San Joaquin saltbush ( <i>Atriplex joaquiniana</i> )	1/
California beaked-rush ( <i>Rhynchospora californica</i> )	1/
Contra Costa goldfields ( <i>Lasthenia conjungens</i> )	1/
Heart Scale ( <i>Atriplex cordulata</i> )	1/
Tiburon Indian paint brush ( <i>Castilleja affinis neglecta</i> )	1/
Contra Costa buckwheat ( <i>Eriogonum truncatum</i> )	1/
Legenere ( <i>Legenere limosa</i> )	1/
Northern California black-walnut ( <i>Juglans californica</i> var. <i>hinksii</i> )	1/
Sanford's arrowhead ( <i>Sagittaria sanfordii</i> )	1/
Gairdner's yampah ( <i>Perideridia gairdneri</i> ssp. <i>gairdneri</i> )	1/
Fountain thistle ( <i>Cirsium fontinale</i> var. <i>fontinale</i> )	SE,1/
Burke's goldfields ( <i>Lasthania burkei</i> )	SE,1/
Mt. Hamilton thistle ( <i>Cirsium fontinale</i> var. <i>campylon</i> )	1/
San Francisco gumplant ( <i>Grindelia maritima</i> )	1/
Hairless popcorn flower ( <i>Plagiobothrys glaber</i> )	1/
Bearded popcorn flower ( <i>Plagiobothrys hystriculus</i> )	1/
Calistoga popcorn flower ( <i>Plagiobothrys strictus</i> )	1/
Swamp sandwort ( <i>Arenaria paludicola</i> )	1/
Showy indian clover ( <i>Trifolium amoenum</i> )	1/
Sepastopol meadowfoam ( <i>Linumnanthes vincularis</i> )	SE,1/
Kenwood marsh checkerbloom ( <i>Sidalcea oregana</i> ssp. <i>valida</i> )	SE,1/
Marin knotweed ( <i>Polygonum marinense</i> )	1/
Palmate-bracted bird's beak ( <i>Cordylanthus palmatus</i> )	FE
White sedge ( <i>Carex albida</i> )	SE,1/
Pitkin marsh lily ( <i>Lilium pardalinum</i> ssp. <i>pitkinense</i> )	SE,1/
Napa bluegrass ( <i>Poa napensis</i> )	SE,1/

## Insects

Lange's metalmark butterfly ( <i>Apodemia mormo langei</i> )	FE
Valley elderberry longhorn beetle ( <i>Desmocerus californicus dimorphus</i> )	FT
Sacramento anthicid beetle ( <i>Anthicus sacramento</i> )	1/
Delta green ground beetle ( <i>Elaphrus viridis</i> )	FT

## Other Invertebrates

Longhorn fairy shrimp ( <i>Branchinecta longiantenna</i> )	FE
California freshwater shrimp ( <i>Syncaris pacifica</i> )	SE, FE
Conservancy fairy shrimp ( <i>Branchinecta conservatio</i> )	FE
Vernal pool fairy shrimp ( <i>Branchinecta lynchi</i> )	FT
California linderiella ( <i>Linderiella occidentalis</i> )	FPE
Vernal pool tadpole shrimp ( <i>Lepidurus packardii</i> )	FE

FE = Federal Endangered

FT = Federal Threatened

FPE = Federal Proposed Endangered

SCE = State Candidate Threatened

1/ = Former Federal Candidate

FPT = Federal proposed Threatened

SSC = Species of Special Concern

ST = State Threatened

SE = State Endangered

SR = State Rare

## FISH

### Splittail

The splittail is a native minnow that lives mostly in the slow-moving stretches of the Sacramento River up to the Red Bluff Diversion Dam, in the Delta, and in the Napa and Suisun marshes (Moyle 1976; DFG unpublished data). They have been found in Suisun Bay, San Pablo Bay, and Carquinez Strait (Moyle 1976). Turner (1966) reported finding them evenly distributed in the Delta, while a later study found them most abundant in the north and west Delta on flooded island areas in association with other native species (DFG 1987).

Splittail are tolerant of brackish water, being caught in salinities as high as 10-12 parts per thousand (ppt) or 15-18 mmhos EC (Moyle 1976). During spring, they congregate in dead-end sloughs of the marsh areas of the Delta, and Napa and Suisun marshes, to spawn over beds of aquatic or flooded terrestrial vegetation (Moyle 1976; DFG unpublished data). They have been observed to migrate up the Sacramento River and spawn at Miller Park.

The splittail commonly reach 12 to 16 inches in length (30-40 cm). It was formerly a commercially harvested fish but now is sometimes sought by recreational anglers in the Delta and Suisun Bay areas. The splittail is now a proposed threatened species. Figure 4-1 displays life history stages and the timing of those stages in the Delta in order to better assess how the Project affects this species.

### Winter-Run Chinook Salmon

The Sacramento River winter-run chinook salmon is distinguishable from the other Sacramento River chinook races by the timing of its upstream migration and spawning season. Before construction of Shasta Dam in 1945, winter-run chinook salmon were reported to spawn in the upper reaches of the Little Sacramento, McCloud, and lower Pit rivers (Moyle et al. 1989). Specific data relative to the historic run sizes of winter-run chinook salmon prior to 1967 are anecdotal with some reports indicating runs that were substantially similar to or even larger than runs that occurred prior to the mid-1960s. Construction of Shasta Dam blocked access to all of the winter-run chinook salmon's historic spawning grounds.

Completion of the Red Bluff Diversion Dam (RBDD) in 1966 enabled escapement estimates of all salmon runs to the upper Sacramento River. The estimated numbers of winter-run chinook salmon passing the dam annually from 1967-1969 averaged 86,509 fish. During 1989, 1990, 1991, 1992, and 1993, however, the spawning escapement of winter-run chinook salmon past the dam was estimated at 547, 441, 191, 1,180, and 341 fish, respectively. The current population is thought to be dangerously low since spawning populations of 400 to

Splittail

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Spawning												

Winter Run

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Adult Upstream Migration												
Juvenile emigration through Delta												

Spring Run

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Adult Upstream Migration												
Juvenile emigration through Delta	yearling										yearlings	

Figure 4-1. Life History of Splittail, Winter-run Chinook Salmon, and Spring-run Chinook Salmon.

1,000 fish are considered necessary to maintain genetic diversity in the winter-run chinook salmon population (52 FR 6041).

The first upstream adult migrants appear in the Sacramento-San Joaquin Delta during the early winter months (Skinner 1972), and move into the upper Sacramento River during December (Vogel and Marine 1991). Adult winter-run migrate to and hold in deep pools between RBDD and Keswick dam prior to initiating spawning activities. The arrival of winter-run chinook salmon in the spawning habitat typically peaks during March, but the peak may vary with river flow, water year type, and operation of the RBDD.

Eggs hatch after incubating about 40-60 days, depending on water temperature. Maximum survival of incubating eggs and preemergent fry occurs at water temperatures between 40 and 56 degrees Fahrenheit. Increased mortality of eggs and preemergent fry commences at 57.7 degrees Fahrenheit and reaches 100 percent at 62 degrees Fahrenheit (Boles 1988). Other potential sources of mortality during the incubation period include redd dewatering, insufficient oxygenation, physical disturbance, diseases, and water-borne contaminants.

Larval incubation lasts approximately 2-4 weeks, depending on water temperature. Emergence of the fry from the gravel begins during late June and continues through September.

The emigration of juvenile winter-run chinook salmon from the upper Sacramento River is highly dependent on individual behavior and streamflow conditions. Storm events can cause emigration of significant proportions of the juvenile population. Emigration past Red Bluff may occur as early as late July or August, generally peaks in September, and may continue through mid-March especially in drier years (Vogel and Marine 1991). During the combined periods of 1978-1979 and 1981-1989, an average of 60 percent of the total downstream emigration past RBDD occurred in September and October (Vogel and Marine 1991).

Numerous factors have contributed to the decline of the Sacramento River winter-run chinook salmon population. The principal factors thought to be responsible for this decline include blockage or interference with adult passage to suitable spawning and rearing areas in the upper Sacramento River (e.g., RBDD and Anderson-Cottonwood Irrigation District dam) temperature induced mortality during egg incubation and early fry development, entrainment of juveniles by water diversion, high levels of juvenile mortality due to downstream passage problems at the RBDD, and the diversion of out migrating juveniles from the Sacramento River into the central Delta via the Delta Cross Channel and other natural waterways where their survival is lower. Other factors that may have adverse effects on winter-run chinook salmon include toxic discharges (particularly from Iron Mountain Mine) and delays in adult migration through the Delta.

Data combined from trawling, seining and State and Federal water project fish salvage records in the Delta show that winter-run chinook salmon outmigrants occur from late September through June in the lower Sacramento River and Sacramento-San Joaquin Delta (Fisher 1993). In any one year, the actual arrival and residence time in the Delta is strongly influenced by the pattern of streamflows and turbidity events in the Sacramento River. The wide distribution of young winter-run chinook salmon throughout the lower Sacramento River and Delta from September through June indicates that juveniles rear in Delta waterways for extended periods of time.

Analysis of adult winter-run chinook salmon scales indicates that most juveniles enter saltwater at a length of 118 millimeters (DFG, unpublished data). Thus, the majority of winter-run chinook salmon juveniles are pre-smolts during the late fall and early winter months. They will undergo smoltification from January through April and are not likely to actively emigrate to the ocean until this time. Fall-run, in contrast, enter saltwater at a much smaller size, approximately 85 millimeters (DFG, unpublished data).

The operation of the intake to the Tracy Pumping Plant in the south Delta is a part of Central Valley Project (CVP) and the operation of the intake to the Harvey O. Banks Pumping Plant, also in the south Delta, is part of the State Water Project (SWP). The National Marine Fisheries Service (NMFS) issued a biological opinion with respect to CVP and SWP operations which prescribes reasonable and prudent measures to avoid jeopardy to winter-run chinook salmon from CVP and SWP operations (NMFS 1995). NMFS has also issued its biological opinion in May that the Delta Wetlands Project will not jeopardize the continued existence of the winter-run chinook salmon or result in the destruction or adverse modification of critical habitat (Attachment 1). Figure 4-1 displays life history stages and the timing of those stages in the Delta in order to better assess how the Project affects this species.

### Spring-run Chinook Salmon

Spring-run chinook salmon were once the most abundant race of salmon in California's Central Valley, and one of the largest runs on the Pacific coast. Large spring-run populations occupied 26 streams in the Sacramento-San Joaquin drainage, principally in the middle reaches of the San Joaquin, Feather, Upper Sacramento, McCloud and Pit rivers and their tributaries. By 1992, however, wild spring-run populations were less than 0.5 percent of the historic runs which numbered up to a million fish (NHI 1994).

Overall population trends for spring run chinook salmon have been documented as declining for many decades. More than 20 historically large populations of spring-run salmon have been extirpated or reduced nearly to zero since 1940. The remnant wild spring-runs on Mill, Deer, Butte, and Big Chico creeks have experienced statistically significant declines over the same period.

Four tributaries to the Sacramento River, Mill, Deer, Chico, and Butte creeks, consistently support annual spawning populations of spring-run chinook salmon. Several other tributaries occasionally have spring-run salmon present or have recently supported small numbers of them. These tributaries include Antelope, Battle, Beegum, Clear, and South Fork Cottonwood creeks. Historically, spring-run salmon occupied the headwaters of all major river systems in California where natural barriers were absent. Spring-run salmon are known to have occurred in the San Joaquin, Merced (near Yosemite), Stanislaus, Tuolumne, Mokelumne, American, Yuba, Feather, McCloud, Pit, and upper Sacramento rivers. Most of the former spring-run habitat was eliminated by water development and dam construction, preventing access to the headwater areas. It is estimated that nearly 85 percent of the former salmon habitat was lost by 1928, primarily spring-run headwater habitat (NHI 1994).

Spring-run chinook salmon were heavily exploited by the early gill-net fishery in the Sacramento-San Joaquin Delta. A large canning industry, although short-lived, targeted spring-run salmon because of their superior condition when captured during their annual spawning run. Early reports by the California Fish Commissioners reported annual gill-net landings in excess of 700,000 spring-run salmon. Before completion of Friant Dam, nearly 50,000 spring-run salmon were counted on the San Joaquin River. As in the San Joaquin drainage, the Sacramento River populations were dramatically reduced following the construction of barrier dams in the 1940s. The most critical barriers were the closures of Shasta Dam on the Sacramento River in 1945 and Friant Dam on the San Joaquin River in 1948. The spring-run chinook salmon became extinct in the San Joaquin drainage and in the mainstem Sacramento River. Spring-run stocks are now limited to spawning in Mill and Deer creeks and possibly Big Chico, Butte and several other east valley creeks (NHI 1994). Spring-run salmon in the Feather and Sacramento rivers have become hybridized with fall-run salmon because of their forced coexistence below major reservoirs.

The majority of adult spring-run chinook salmon migrate into the Bay-Delta Estuary from mid-March through June. Some evidence from tagging studies indicates freshwater entry into the lower river may actually begin in mid-February. Both spring-run and winter-run migrate coincidentally, with each race segregating into separate holding and spawning areas apparently influenced by suitable water temperatures for spawning and reproductive success. No winter-run salmon migrate into Mill, Deer, Chico, or Butte creeks where summertime water temperatures are adequate for holding adults but lethal to incubating salmon eggs.

Spring-run spawning times have been poorly documented and reported as occurring at a variety of times. The most thorough record appears in the reports from the Baird Hatchery on the McCloud River. Adult spring-run salmon begin entering tributaries in early-March, continuing through April, and peaking in May. The upstream movement concludes by the end of June effectively isolating spring-run salmon in the headwater holding and spawning areas. Spawning takes place from mid-August to the mid-October. Recent spawning stock surveys in

Deer Creek have confirmed that the onset of spawning begins in late-August and continues to mid-October. There appears to be some variation in spawning times within different drainage, possibly related to water temperatures. Those populations spawning at higher elevations such as Mill and Deer creeks spawn approximately 3 weeks earlier than those in Butte and Chico creeks, where spawning activity is first noted in mid-September. Within Deer Creek, spawning begins first at upstream areas and occurs progressively later at lower elevations.

Additional complexity and variability of spring-run life history results from the different emergence times within different drainage. Early migration extending from early-December through June appears to be the dominate time of juvenile emigration in Butte and Chico creeks. However, some yearling salmon have been collected in January and February, which indicates some unknown portion of the juveniles over summer in the creeks to out migrate in the following fall. Yearling emigration from mid-October through March is significant in Mill and Deer creeks. The fall migration out of the drainage appears to respond to seasonal runoff events. Early season storms stimulate early outmigration (NHI 1994). In years of high late-spring runoff, coinciding with fry emergence, a large juvenile migration of age 0 fry is prompted similar to that observed in Butte Creek. Figure 4-1 displays life history stages and the timing of those stages in the Delta in order to better assess how the Project affects this species.

### Delta Smelt

The delta smelt is a small, slender fish about 2-3 inches long endemic to the Sacramento-San Joaquin Estuary. Adult smelt spawn in freshwater, primarily in the channels and sloughs of the Delta (Moyle, et al. 1992). Adults begin migration to freshwater spawning areas during November through January. Recent SWP and CVP salvage data indicates salvage of adult delta smelt is highest in January and second highest in February.

During January through June, adhesive demersal eggs are spawned over aquatic vegetation, rocks, gravel, tree roots, and other submerged substrates (U.S. Fish and Wildlife Service 1993b). The eggs hatch within 9-14 days depending on water temperature and the buoyant larvae are carried by currents downstream to the upper end of the entrapment zone (EZ) i.e., the saltwater/freshwater interface of the Sacramento-San Joaquin Estuary.

Larvae and juvenile smelt generally rear in or upstream of the EZ (U.S. Fish and Wildlife Service 1993b). The EZ may be located in the channels of the Delta, in Suisun Bay, or further downstream, depending on the volume of Delta outflow. Location of the EZ in the Delta (i.e., reponding to Delta outflow less than about 10,000 cfs [Kimmerer 1992]) is believed to provide less favorable conditions than is provided when the location of the EZ is in Suisun Bay. The decline of the smelt population since 1983 may be associated with the occurrence of the EZ in the Delta channels, especially during the drought years 1987-1992

when monthly Delta outflow generally averaged less than 7,000 cfs during the spawning and rearing periods.

Recent SWP and CVP salvage data indicate salvage of young-of-the-year delta smelt is highest in June with July being the second highest.

The one-year life span and relatively low fecundity of delta smelt contribute to their vulnerability to extinction when population abundance is low. Factors that may reduce population abundance and drive the species toward extinction include (Moyle and Herbold 1989):

- reduced Delta inflow and outflow;
- extremely high Delta outflow (relatively rare flood events, i.e., 1983);
- entrainment in water diversions;
- perturbations to the smelt's food web (reduced abundance of phytoplankton and zooplankton, competition and predation by introduced species);
- presence of toxic substances (agricultural, industrial, and municipal discharges) in the smelt habitat; and
- loss of genetic integrity caused by reduced abundance of adult smelt.

The USFWS issued a biological opinion for the operation of the CVP and SWP, which prescribes reasonable and prudent alternatives to avoid jeopardy to delta smelt and Sacramento splittail from CVP and SWP operations (USFWS 1995). The USFWS issued its biological opinion in May 1997, that the Delta Wetlands Project will not jeopardize the continued existence of the delta smelt and Sacramento splittail or result in the destruction or adverse modification of their critical habitat (Attachment 1). Figure 4-2 displays life history stages and the timing of those stages in the Delta in order to better assess how the Project affects this species.

### Longfin Smelt

The longfin smelt occurs from the Bay-Delta Estuary in California to Prince William Sound in Alaska. Longfin smelt is an euryhaline species with a 2-year life cycle. Spawning occurs in fresh water over sandy-gravel substrates, rocks, or aquatic plants. Spawning may take place as early as November and extend into June, although the peak spawning period is from February to April. After hatching, larvae move up into surface water and are transported downstream into brackish-water nursery areas. Delta outflow into Suisun and San Pablo bays has been positively correlated with longfin smelt recruitment because higher outflow increases larval dispersal and the area available for rearing. The longfin smelt diet consists of neomysids, although copepods and other crustaceans also are eaten. Longfin smelt are preyed upon by fishes, birds, and marine mammals (Federal Register Vol. 59 No. 4).

In the Bay-Delta Estuary, the decline in longfin smelt abundance is associated with freshwater diversion from the Delta. Longfin smelt may be particularly sensitive to adverse habitat alterations because their 2-year life cycle increases their likelihood of extinction after consecutive periods of reproductive failure due to drought or other factors. Relatively brief periods of reproductive failure could lead to extirpations (Federal Register Vol. 59 No. 4).

Although the southernmost populations of longfin smelt are declining, little or no population trend data are available for estuaries in Oregon and Washington. The listing of a Bay-Delta Estuary population segment is also not warranted at this time because that population does not seem to be biologically significant to the species as a whole, and may not be reproductively isolated (Federal Register Vol. 59 No. 4). Figure 4-2 displays life history stages and the timing of those stages in the Delta in order to better assess how the Project affects this species.

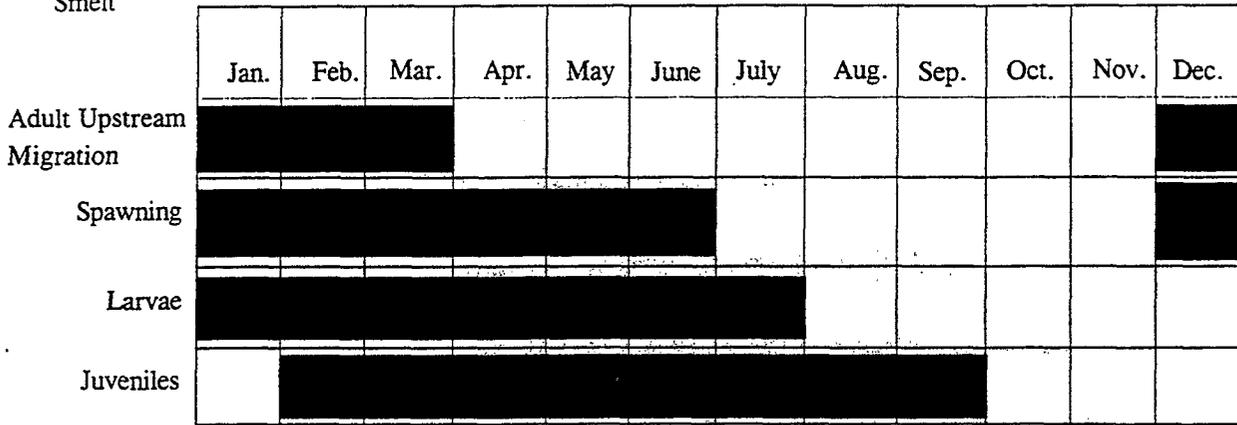
### Sacramento Perch

The Sacramento perch is the only native Centrarchid west the Rocky Mountains. This species was once abundant in natural lakes, sloughs, and slow moving rivers of central California. The perch has been largely extirpated from the Delta, but surveys conducted by the DFG caught five Sacramento perch in Suisun Marsh from 1974 to 1979. In July of 1992, a DFG fishery biologist identified a Sacramento perch caught by an angler near Westgate Landing on the south fork of the Mokelumne River. Currently, in California, a viable native population of Sacramento perch exists in Clear Lake, Lake County. Introductions of Sacramento perch have occurred throughout the State in isolated farm ponds and reservoirs.

Sacramento perch can tolerate a wide range of water conditions, such as salinities of up to 17 ppt and water temperatures that exceed 77 °F. This adaptation is thought to have evolved in response to historical environmental fluctuations resulting from periods of flooding and drought. Throughout the Central Valley, the Sacramento perch inhabited sloughs, slow-moving rivers, and lakes that contained areas dominated by rooted emergent and submerged vegetation, which is critical for spawning and nursery habitat of young fish.

The decline of the Sacramento perch has been linked to several factors: competition with introduced species for food and spawning resources, predation by introduced species on eggs and young fish, and habitat alterations. The Sacramento perch's main competition comes from introduced species within its own family, such as black crappie, largemouth bass, small mouth bass, and bluegill. Competition may have forced the less aggressive Sacramento perch to utilize areas that are less suitable for spawning and feeding. When the perch is forced out of preferred habitats into areas that are less desirable, their reproductive success is limited. In Clear Lake, the

Delta Smelt



Longfin

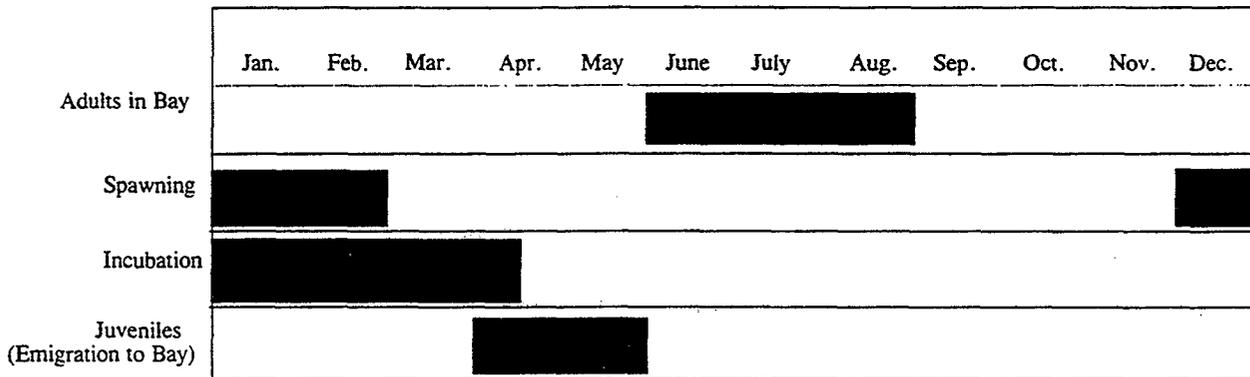


Figure 4-2. Life History of Delta Smelt and Longfin Smelt

Sacramento perch reproduction may be successful only when the population of black crappie is low. Moyle (1976) also reported that catfish and carp have been observed moving across spawning beds of the Sacramento perch eating deposited eggs. The introduction of these and other non-native species happened almost simultaneously with the occurrence of major habitat alterations in the Delta. Reduction in suitable habitat has occurred since the late-1800s when changes in the upstream hydraulic operations (dams, water diversions, and mining) altered the flow patterns of the Delta and its tributary streams. Construction of levees led to the loss of vast amounts of suitable spawning and nursery habitat in the Delta. Rip-rapping of channel and slough edges in the Delta further reduces the remaining habitat.

Stocking of Sacramento perch is currently limited to farm ponds and impoundments. Introductions into impoundments where other Centrarchid species are present have failed, and when stocked into impoundments where no other fish exist, they over-populate and growth becomes stunted (Moyle 1976).

### Green Sturgeon

Green sturgeon have been taken in salt water from Ensenada, Mexico to the Bering Sea and Japan. They are found in the lower reaches of large rivers from the Sacramento-San Joaquin Delta northward, including the Eel, Mad, Klamath, and Smith rivers. Although spawning has not been confirmed in the Delta, juveniles are common in freshwater areas, especially in the summer. The diet of green sturgeon appears to consist primarily of neomysids and amphipods (Moyle 1976).

## REPTILES

### Giant Garter Snake

The giant garter snake is listed by the State of California as a threatened species. It is endemic to the Sacramento and San Joaquin valleys, where it presently occurs in a clumped distribution pattern from Butte to Fresno counties. It has been extirpated from the San Joaquin Valley south of Fresno County and has recently suffered serious declines in southern Sacramento County (Hansen and Brode 1980; Hansen 1982, 1986, 1988).

The original range of the GGS, as reported by Fitch (1940), was the floor of the Great Valley of California from Sacramento and Antioch southward to Buena Vista Lake. Fox (1951) indicated that intergrades between the GGS and a closely related subspecies, *T. e.*

The distribution of the GGS in the Sacramento Valley coincides for the most part with the major flood basins, including the American Basin, that historically formed along the Sacramento River.

Before reclamation was undertaken along the river, about 60 percent of the Sacramento Valley was subject to overflow which seasonally filled the broad, shallow flood basins. These basins supported heavy growths of tules. Today, only remnants of these once vast tules stands remain. The GGS inhabits sloughs, low gradient streams, and other waterways where it feeds on small fish and frogs. It finds shelter along banks and in adjacent uplands. It adapts well to man-made waterways as long as they have the primary requirements of (1) enough water during the active (summer) season to supply food and cover, (2) grassy banks for basking, (3) emergent vegetation for cover during the active season, and (4) high ground or uplands that provide cover and refuge from flood waters during the dormant (winter) season (Hanson 1988).

As a result of human activities, wetland habitats and GGS they once supported have been seriously depleted throughout the GGS's original range.

Housing, business, industrial, and recreational development have replaced GGS habitats with broad urban areas entirely unsuitable for these snakes. Wetlands have been drained and streams channelized, concreted, and even routed through underground pipes. Other habitats have been converted to landscaped green belts and managed as parks or other uses detrimental to GGS. Those GGS remaining in or near urban areas have been subjected to a host of hazards including loss of habitat, pollution, destruction of food sources, predation by native and introduced species and removal by amateur and commercial collectors.

While agriculture may benefit GGS under certain conditions by providing habitat and food along irrigation canals, many agricultural practices are detrimental to GGS.

GGS have been lost during tilling, grading, harvesting, and other operation of mechanical equipment within supporting habitats through direct physical injury and through exposure to predators and other stresses related to loss of shelter.

GGS habitats have lost their ability to support GGS when exposed to heavy grazing due to loss of protective plant cover (including tules). Soil compaction resulted in the destruction of underground and aquatic retreats such as rodent and crayfish burrows and other cracks and holes. Remaining GGS have been exposed to predators and other stresses related to loss of shelter.

GGS, functioning near the top of aquatic food chains, have been exposed to a wide array of chemical and other pest control measures. The effects of such measures as agricultural pest control and mosquito abatement (both of which applied large quantities of DDT and its successors within the habitats of GGS) remain unknown. Weed abatement and rodent control measures, especially along canal or other stream banks, has destroyed surface and underground shelter.

Human activities have resulted in widespread introductions of non-native species and redistribution of native species with the potential to compete with or prey on GGS. The terrestrial garter snake (TGS) and Valley garter snake (VGS) and a host of other animals such as skunks, raccoons, and housecats have been provided access to previously aquatic or semiaquatic environments through the conversion of these habitats to other uses.

Large predatory "gamefish" species have also been introduced into nearly all permanent freshwater environments within the Project Area. Since such aquatic predators did not previously occur here, these introductions affected GGS by preying on GGS and by competing with them for smaller forage fish. The tendency of these snakes to enter the water of forage or to escape enemies now places them at greater risk than previously.

GGS is an aquatic feeder specializing in ambushing fish underwater. It also readily takes larvae and young of the widely introduced bullfrog. A site must provide GGS protection (both in and out of water) from predation and other mortality factors during the active season. This shelter may take the form of vegetation or debris, or the burrows of rodents and crayfish.

Those sites that were populated by GGS provided access to upland retreats during runoff or flooding. Vegetation, burrows, and other shelter from predators at these upland retreats enhance the suitability of the site.

GGS bask during the active season in order to raise the body to activity temperatures. Basking may be an especially important aid to digestion, gestation, and healing and in rewarming

the body following emersion in cool waters. While basking spots may be provided by vegetation and debris present within the habitat, dense overstories of riparian growth may block warming sunlight. Conversely, a lack of screening vegetation on a sunny stream bank exposes basking GGS to view by predators. If too few suitable basking spots are present in an otherwise favorable habitat, avian or other predators may concentrate their activities at those spots to the detriment of GGS.

Although the original GGS habitat within the Central Valley has largely been lost, man-made irrigation canals and ditches associated with rice farming and other agriculture now provide important habitat. GGS use the canals for year-round habitat and movement between major population centers. The GGS occurs in a wide variety of canals and ditches in the area. Some are densely vegetated with little disturbance and some have a dirt road along one or both sides. Most of these waterways are ideal for the GGS because they are too small to support large predatory fish, but large enough to provide adequate food and cover.

The rice fields provide important habitat during late summer, when the fields are flooded and contain large numbers of mosquitofish (*Gambusia affinis*), Pacific treefrogs (*Hyla regilla*) and other food items. This food source may be especially important to newborn GGS.

#### Northwestern Pond Turtle

The northwestern pond turtle occurs from the vicinity of the American River northward to the Columbia River. Within the Estuary, the northwestern pond turtle is found north of San Francisco Bay, while the southwestern pond turtle is found south of San Francisco Bay. These turtles, which are found in water that ranges from fresh to brackish to seawater, inhabit marshes, ponds, and small lakes with abundant vegetation, creeks, slow-moving streams, sloughs with riparian habitat, and irrigation ditches with emergent vegetation. Habitat requirements include well-vegetated backwater areas with logs for basking and open sunny slopes away from riparian zones for egg deposition. Western pond turtles nest up to 400 meters from and 60-90 meters above stream banks on sand banks along the courses of large rivers, or on hillsides in foothill regions. The turtles mate in April and May, and eggs are laid from June through August. The hatchlings overwinter in nests and emerge in March or April. Sexual maturity in pond turtles is thought to occur at about eight years and they may live for 30 to 40 years (DWR 1994, Jennings et al. 1992).

The continuing loss of suitable nesting habitat may result in inadequate reproduction rates in some areas. Extensive water diversion for agriculture and other purposes has led to the reduction of western pond turtle numbers in California. Dredging also destroys suitable habitat, as does the construction of dams and reservoirs.

## Southwestern Pond Turtle

The southwestern pond turtle, previously a federal category 2 candidate species, ranges from San Francisco Bay south into northwest Baja California. It is restricted in its range to land west of the crest of the Sierra Nevada (Pritchard 1979, Behler and King 1979). It can be found from the Lower Sonoran into the Transition life-zones (Stebbins 1954).

The pond turtle is considered to be thoroughly aquatic in its habitat preference (Smith and Brode 1982). It selects quieter pools and backwaters in swifter streams. It has been seen in brackish water (Behler and King 1979, Stebbins 1954, Stebbins 1966, Pritchard 1979; Pope 1939). It is more common in areas with muddy or rocky bottoms that are overgrown with aquatic vegetation such as cattails, watercress, or water lilies. They use mudbanks, logs, and cattail mats for basking (Stebbins 1954, Stebbins 1966). Pond turtles seek deep water with masses of waterlogged leaves and brush for escape cover (Van Denburgh 1922).

The southwestern pond turtle is the most carnivorous member of the genus *Clemmys* (Smith and Brode 1982). Food consists of aquatic plants such as yellow pond lily pads (Stebbins 1954), insects such as aquatic beetles (Pope 1934), and carrion (Stebbins 1966).

Pond turtles hibernate in winter. The exact extent of the hibernation period varies with season, altitude, and latitude. It is active in March in southern California. Pond turtles hibernate in the mud of stream or pond bottoms (Pope 1939, Stebbins 1954).

Nesting in central California takes place in late April and May. Nesting sites are usually located in a sunny place near a pond, stream, or river, but nesting sites may also be in an open field or hillside hundreds of yards from water (Pope 1939, Stebbins 1954).

## BIRDS

### Bald Eagle

The bald eagle, a state- federally-listed endangered species, is a large brown bird of prey which, as an adult, has a white head and tail. The bald eagle occurs widely in North America and winters throughout most of California at lakes, reservoirs, river systems, interior and coastal wetlands, and some rangelands. The breeding range is mainly in mountainous habitat near reservoirs, lakes and rivers in the northern quarter of the State; some pairs also breed in southern California on Santa Catalina Island and mainland Santa Barbara County. The winter population appears to be stable, and the breeding population is increasing in number and range. The size of the winter population varies from year to year and may exceed 1,000 birds some winters (as in 1987-88). Eighty-three breeding pairs occupied breeding sits in 1989. The Pacific Bald Eagle Recovery Plan (1986) establishes geographical goals for population recovery. The multi-agency California Bald Eagle Working Team provides guidance to agencies and groups in management and research matters, and the team is preparing a management plan for bald eagles in California to assist in implementing the recovery plan. Many breeding territories are being maintained and protected under local management plans. Key winter habitats are receiving increasing attention in terms of population monitoring, site protection, and public viewing and education. Several entities, including Pacific Gas and Electric Company and U.S. Forest Service, are currently sponsoring intensive ecological studies. Other research efforts are under way on contaminants, human disturbance, and other issues that affect this species. Several bald eagle studies, including population restoration efforts on the Channel Island, have been supported with Tax Check-off funding assistance.

Bald eagles are occasional winter visitors in the Sacramento-San Joaquin Delta. The bald eagle is predominately a fish-eating bird, however, other prey items may include birds, amphibians, and reptiles. They forage over the lake and hunt from perches in trees along the shoreline, particularly where the banks are steep.

### American Peregrine Falcon

This species nests in the Sierra Nevada, the mountains of northern California, and along the coast. It is found inland, during winter, throughout the Central Valley and occasionally on the Channel Islands. It migrates during the spring and fall throughout California. Riparian areas, and coastal and inland marshes are important year-round habitats, while breeding typically takes place in woodland, forest, and coastal habitats on cliffs.

It requires protected ledges for cover and preys upon many different bird species, up to

the size of ducks. It utilizes cliffs in the vicinity of lakes, rivers or marshes. It stoops from flight to intercept flying prey.

This species is both state and federally listed endangered. Populations have been increasing in recent years. DFG researchers have recorded 106 breeding pairs in California in 1990. This species is highly susceptible to eggshell thinning induced by ingestion of DDT and its primary metabolite DDE. The low reproductive rates for the coastal population is probably due to heavier DDE loads received from migrant prey species. California has established several ecological reserves to protect peregrine nesting sites. The Predatory Bird Research Group (Santa Cruz, California) has operated a captive rearing program to help augment wild peregrine populations.

### Aleutian Canada Goose

This subspecies of Canada goose breeds in the Aleutian Islands. Its main wintering grounds are in the Central Valley of California. This goose generally leaves the Aleutians in late-September for its southward migration. Following stops along the Oregon coast and the California coast above Crescent City, it arrives in the Central Valley from October to November. The geese use the Sacramento Valley marsh and agricultural areas in early winter. In December and January, Aleutians are typically found using suitable habitat in the upper San Joaquin Valley near Los Banos and south of Modesto. Use of Suisun Marsh by these birds is sporadic. Preferred foraging areas include lightly grazed pasture lands. Aleutians feed on green shoots and seeds of cultivated grains as well as wild grass and forbs. The return migration to the north occurs from late-February through April.

The Aleutian Canada goose was originally listed as endangered by the USFWS due to its severely depleted population. Nest predation in breeding areas was the principal cause. The sport hunting harvest of this reduced population exacerbated the decline. Recovery efforts focused on removal of predators from the breeding islands and hunting restrictions. The population has now rebounded from an estimated wintering population of 800 in the mid- 1970's to over 5,000 currently. As a result, the USFWS has recently down-listed this subspecies to threatened. Continued maintenance of suitable wintering habitat, including managed marsh and suitable agricultural lands, such as small grains and pasture, is important for the continuing recovery of this species.

The Aleutian Canada goose infrequently utilizes the areas that will be affected by the proposed project. The proposed standards include standards for the managed marsh in Suisun Marsh which are intended to maintain and improve habitat conditions, in part, for waterfowl.

## California Black Rail

The California black rail is a rare year-long resident of tidal salt marshes and brackish and freshwater marshes in the San Francisco Bay area, Sacramento-San Joaquin Delta, coastal southern California at Morro Bay, the Salton Sea, and lower Colorado River area. Formerly a local resident in coastal lowland marshes from Santa Barbara County to San Diego, it still winters there rarely. Significant loss of saltwater, brackish, and freshwater wetland habitat has contributed to reduced populations. Extreme high tides in tidal marshes and water level fluctuations in freshwater marshes have disrupted nesting attempts. Loss of high marsh vegetation around San Francisco Bay has also eliminated the species as a breeder in the south bay (Manolis 1977).

Since black rails usually frequent upper marsh zones, during extreme high tides, they may depend on the zone where the upper marsh vegetation intergrades with peripheral, upland or freshwater marsh vegetation for cover.

Black rails are carnivorous. They glean and peck for a variety of arthropods (e.g., isopods and insects) from the surface of mud and vegetation.

Black rails occur most commonly in tidal saltmarshes dominated by pickleweed or brackish marshes supporting bulrushes, in association with pickleweed. In exclusively freshwater marshes where black rails occur, bulrushes and cattails are usually present.

Rail nests are concealed in dense marsh vegetation, such as pickleweed, near the upper limits of tidal flooding and consist of a loosely-made, deep cup which may be at ground level or elevated several inches high. The black rail is state listed threatened and was previously a federal candidate species.

## Tricolored Blackbird

The tricolored blackbird is largely endemic to California but also occurs in extreme southern Oregon, western Nevada, and northwestern Baja California (Neff 1937). This species' historical breeding range in California included the Sacramento and San Joaquin Valleys and low foothills of the Sierra Nevada from Shasta County south to Kern County, along the coast from Sonoma County south to the Mexican border, and on the Modoc Plateau (Dawson 1923, Grinnel and Miller 1994).

Although tricolored blackbird populations have declined throughout their range, they continue to breed in the Central Valley up to the low foothills (DFG 1988), in coastal areas from Sonoma county south to Baja California, and on the Modoc Plateau south to the Honey Lake

Valley, Lassen County (Garrett and Dunn 1981, McCaskie et al. 1975a). A statewide survey conducted during 1968-1972 indicated that 78 percent of the 168 colonies located were in highly agricultural portions of the Central Valley (DeHaven et al. 1975a). Populations in this region may have declined by 50 percent from the 1940s (DeHaven et al. 1975a). Tricolored blackbird band recoveries suggest that wintering individuals may travel the entire length of the Central Valley, and from there into the San Francisco Bay-Delta area, the northeastern plateau region of California, and southern Oregon (Neff 1942, DeHaven et al. 1975b).

Nonbreeding tricolored blackbirds forage in large nomadic flocks and often mingle with other blackbirds (Orians 1980). During winter and fall, tricoloreds consume mostly weed seeds and waste grain (especially rice and water grass) from agricultural fields (Crane and DeHaven 1978).

Breeding tricolored blackbirds forage at freshwater marshes, wet pastures, margins of ponds, agricultural fields, barnyards, and feedlots (Beedy and Hayworth 1993). Although breeding tricoloreds may fly 2-4 miles from their colonies to seek food (Neff 1937, Orians 1961), they typically exploit locally abundant and changing food supplies and minimize the distance of their foraging flights (Crane and DeHaven 1977).

Breeding tricolored blackbirds forage opportunistically and glean insects and seeds from dry ground, flooded fields, mudflats, floating algal mats, and low vegetation; occasionally they hawk insects in midair (Beedy and Hayworth 1993). Breeding season foraging studies in Merced County showed that animal matter makes up about 91 percent of the food volume of nestlings and fledglings, 56 percent of the food of adult females, and 28 percent of adult males (Skorupa et al. 1980). The animal taxa most often consumed were beetles (63 percent), butterflies and moths (35 percent), and flies (14 percent). Plant foods eaten most often included oats (27 percent), chickweed (15 percent), and filaree (9 percent) (Skorupa et al. 1980).

Although the dietary water requirements of adult tricolored blackbirds are apparently unknown, observations suggest that breeding colonies need water on or near their colonies (Beedy 1989). Of seven colonies examined by Beedy and Hayworth (1993), six were situated above standing water and one was within about 200 yards of a flowing canal.

Tricolored blackbirds nest in dense colonies in the vicinity of fresh water, especially in marshy areas with heavy growths of cattails (*Typha* spp) and tules (*Scirpus* spp.) (Grinnell and Miller 1944). In addition to these preferred nesting substrates, tricolored blackbirds also nest in other vegetation, such as willows (*Salix* spp), thistles (*Centaurea* spp.), mustard (*Brassica* spp.), nettles (*Urtica* spp), blackberries (*Rubus* spp.), salt cedar (*Tamarix* spp), giant cane (*Arundo donax*), wild grapes (*Vitis* spp.), and wild roses (*Rosa* spp.) (Neff 1937, DeHaven et al. 1975a, Hosea 1986). Proximity to productive foraging grounds such as flooded fields, margins of ponds, and grassy fields is also important in nest site selection (Grinnell and Miller 1944).

An important link in the tricolored blackbird nesting cycle is the availability of patchy, superabundant food supplies that may not be readily detected by humans. A lack of food may explain why many seemingly suitable habitats are unoccupied by tricoloreds. Thus, the quality, not only the extent, of habitat is of paramount importance (Beedy 1989).

Tricolored blackbirds typically initiate nest building in early or mid-April (Orians 1961), and breeding activity has been observed until early July (Beedy and Hayworth 1993). Rarely, tricolored blackbird populations have been observed nesting during October and November in the Sacramento Valley (Orians 1960, Payne 1969). Generally, nests are concentrated within a fraction of the total area available (Beedy 1989).

This species is the most intensely colonial of all North American passerines (Orians 1980) with as many as 20,000 nests located in an area of 10 acres or less (Dehaven et al. 1975a).

Within established nesting areas, tricolored blackbirds are extremely sensitive to predators, and even relatively minor disturbances can cause abandonment of entire colonies (Beedy 1989). Historical literature describes predation by mammals (Heerman 1853, Mailliard 1914, Evermann 1919) causing major nesting failures. Other observers have also reported massive tricolored blackbird nesting failures due to bird and mammal predators (Neff 1937, Lack and Emlen 1939), poisoning (McCabe 1934), and human disturbance (Beedy and Hayworth 1993).

### Swainson's Hawk

The Swainson's hawk was described in early accounts as one of the most common raptors in California (Sharp 1902). The species occurred throughout much of lowland California, hunting in open grassland habitats and nesting along the edges of riparian forests or oak woodlands, or in isolated trees that were scattered across the valley savannas.

Pre-agricultural California supported abundant woodland and grassland habitats, particularly throughout the Central Valley. Since the mid-1800s, these native habitats have undergone a gradual conversion to agricultural uses. Today, native grassland habitats are much reduced in the state, and only remnants of the once vast riparian forests and oak woodlands still exist (Katibah 1983).

The effect of widespread loss of both nesting and foraging habitats on Swainson's hawks has been a significant reduction of the breeding range and the breeding population in California (Bloom 1980). The state currently supports an estimated 550 breeding pairs of Swainson's hawk, representing less than 10 percent of the historic population (California Department of Fish and Game 1988). To provide protection for the remaining population, the State of California listed the Swainson's hawk as a threatened species in 1983.

The largest segment of the California Swainson's hawk population exists in the Central Valley, where an estimated 440 pairs nest (California Department of Fish and Game 1988). Although agricultural conversion of native habitats was probably the primary factor responsible for initial Swainson's hawk declines in the state certain agricultural practices are largely responsible for maintaining current populations. The row, grain, and hay crop farming typical of the mid-section of the Central Valley is compatible with Swainson's hawk foraging habitat needs. The distribution of the Central Valley population is closely correlated with the distribution of these cropping patterns. This region of suitable agricultural foraging habitat is considered essential in maintaining the stability of the Central Valley Swainson's hawk population.

Swainson's hawks usually nest in large, mature trees. Native trees are almost always used, although nests have been found in eucalyptus (*Eucalyptus* sp.) trees and ornamental conifers. Tree species most commonly used in the Central Valley in decreasing order of frequency include valley oak (*Quercus lobata*), Fremont cottonwood (*Populus fremontii*), black walnut (*Juglans hindsii*), and willow (*Salix* sp.). Nests are usually of flimsy construction and often blow out of the nest tree during high winds, particularly during winter.

Although nest sites are not found exclusively in riparian habitat, more than 87 percent of the known nest sites in the Central Valley are within riparian systems (Schlorff and Bloom 1983, Estep 1984). Swainson's hawks also nest in roadside trees, isolated individual trees, small groves, and on the edges of remnant oak woodlands.

Swainson's hawks are highly traditional in their use of nesting territories, returning each year to the same nest tree or a tree nearby. Many nest sites in the Central Valley have been monitored annually since 1978, and a program of color banding nesting pairs has been ongoing since 1986. These studies show a high degree of nest site and mate fidelity among pairs.

The Swainson's hawk is adapted to foraging in large, open plains and grasslands. In the Central Valley, however, virtually all native foraging habitat has been converted to agricultural uses, restricting Swainson's hawks to areas that support cropping patterns compatible with their foraging requirements. Both the abundance of prey populations and the accessibility of prey to foraging birds determine the suitability and quality of agricultural foraging habitat for Swainson's hawks. The many crop types grown in the Central Valley differ widely with respect to their foraging habitat suitability.

Swainson's hawks hunt aurally almost exclusively in the Central Valley, soaring from 100 to 300 feet above the ground while scanning for prey (Estep 1989). Foraging birds select fields that are most compatible with this type of foraging behavior (i.e., fields that are large, support low cover to provide access to the ground, and provide the highest densities of accessible prey). These habitats include hay and grain crops, lightly grazed pasture lands, and certain row crops, such as tomatoes and sugar beets. Fields lacking adequate prey populations, such as flooded rice

fields, or those that are inaccessible to foraging birds, such as vineyards and orchards, are avoided.

Cropping patterns directly affect the foraging behavior, foraging range size, and ultimately the reproductive success of nesting Swainson's hawks. As crops mature, vegetative cover increase, which decreases prey accessibility; as a result foraging birds expand their ranges in search of fields that provide accessible prey. Foraging Swainson's hawks have been observed traveling more than 9 miles from their nest in search of prey (Estep 1989). Later in the season, as crops are harvested, foraging ranges decrease as prey become more accessible near the nest. Prey abundance has also increased by the time harvesting operations proceed. The result is that foraging ranges can fluctuate both seasonally, in response to changes in prey accessibility and abundance, and from year to year in response to changing cropping patterns. Overall foraging ranges (averaging 6,800 acres) ranks the habitat quality of various crops grown in the Central Valley as high, moderate, or low based on their value to foraging Swainson's hawks.

Corn and wheat, the primary crops grown in the central Delta, provide suitable foraging habitat for nesting Swainson's hawks. However, most of the crop types in the central Delta are suitable as foraging habitat only during part of the breeding season. The timing of corn and wheat planting and harvesting are complementary, providing suitable foraging habitat throughout most of the breeding season.

Both corn and wheat provide foraging habitat during the early part of the breeding season. Wheat fields become less suitable in April as the crop matures. Cornfields continue to be suitable for foraging through May. As cornfields mature, they also become unsuitable, but by late June to early July, wheat is harvested and harvested wheat fields again become suitable habitat. Thus, it is possible that suitable habitat is available to foraging Swainson's hawks on central Delta islands throughout most of the breeding season. The central Delta also supports other row, grain, and hay crops and pastures that attract foraging Swainson's hawks.

Swainson's hawks are known to nest in the central Delta and individuals are occasionally observed foraging on the central Delta islands, including the Project islands, during the breeding season, (Jones and Stokes Associates 1990a, Holt pers. comm.). Pairs that nest outside the Delta may also forage on Delta islands during certain times of the year, particularly during periods of harvest or during periods of foraging range expansion, which occurs when prey is limited near the nest (Estep 1989).

In general however, Swainson's hawks will limit their foraging movements to stay as close to the nest as possible. Thus, foraging frequency declines with distance from the nest. In most cases, nest sites are located near high-quality foraging habitat; thus, hawks will travel far from the nest only if necessary, based on both the crop patterns near the nest and availability of suitable habitat elsewhere.

Although an unusual occurrence at northern latitudes, the Delta is also used by Swainson's hawks during the winter. Swainson's hawks are migratory, and most spend winters in South America. Individuals, however, have been sighted during winter in the Delta over the last 10 years (Holt pers. comm.). In 1990-1991, a group of 29 adult Swainson's hawks was regularly observed on Bouldin Island and neighboring Venice Island for several weeks. These birds appeared to be attracted to the abundance of prey that resulted from the discing and flooding operations on the islands. A key roost area was a stand of eucalyptus trees across the Mokelumne River from Bouldin Island on neighboring Tyler Island, where the group roosted for several weeks.

The above information was taken into consideration when the DFG developed its mitigation guidelines for the Swainson's hawk.

### Greater Sandhill Crane

The greater sandhill crane is the largest of four recognized subspecies of sandhill crane (Walkinshaw 1949). The greater sandhill crane is a wetland-associated bird, requiring marsh and meadow habitats during the breeding season, and shallow wet habitats for roosting during winter. This subspecies feeds primarily on invertebrates, roots, tubers, and certain cereal grains during the winter (Schlorff et al. 1983).

Four populations of greater sandhill crane are recognized: Eastern, Rocky Mountain, Colorado River Valley, and Central Valley. The Central Valley population nests from northeastern California to British Columbia (U.S. Fish and Wildlife Service 1978, Pogson and Lindstedt 1988). The entire Central Valley population, estimated at 3,400-6,000 individuals (California Department of Fish and Game 1989), winters in the Central Valley, along with the entire Pacific Flyway population of lesser sandhill crane (*Grus canadensis*) (Pogson et al. 1988).

Seven sites in the Central Valley are considered important wintering sites for the greater sandhill crane: Sacramento-San Joaquin River Delta, Chico, Butte Sink, Angel Slough, Modesto, Merced, and Pixley. The most important of these sites is the Sacramento-San Joaquin Delta, which supports as much 75 percent of the Central Valley population during late winter (Pogson and Lindstedt 1988).

Both roosting and foraging habitat are essential to Central Valley population during winter. Greater sandhill cranes congregate in communal roosts at night, and fly off each morning to forage in suitable fields, pastures, or other shallow wetland habitats. Most traditional foraging areas are near (within 2-3 miles) communal roost sites. Thus, the proximity of foraging habitat to communal roost sites is an important determinant of suitable wintering habitat.

Communal roost sites are typically large fields (100+ acres), flooded with one to ten inches of standing or slowly moving water, and with relatively low-relief shorelines (Pogson and Lindstedt 1988). Most roost sites in the Central Valley are on private duck clubs, and have been created to attract wintering waterfowl.

Foraging habitat for the Central Valley population varies at different locations in the Central Valley. The primary source of carbohydrates is cereal grains: waste corn in the Delta and Modesto regions and waste rice in the Sacramento Valley (Pogson and Lindstedt 1988). Cranes also forage on wheat sprouts in newly planted winter wheat fields and on sprouts, shoots, tubers, invertebrates, and seeds in fallow fields and in uncultivated habitats (field borders, levees, canal and irrigation ditch banks) (Pogson and Lindstedt 1988).

Greater sandhill cranes begin arriving in the Central Valley in October. During winter, the distribution of the Central Valley population shifts as cranes move between the major wintering sites. Records from Pogson and Lindstedt (1988) and Department crane surveys indicate that populations in the Delta are relatively small in October (from zero to about 1,500 cranes) and begin increasing in mid-November to late November. The Delta population peaks in January and February (4,000-5,000 cranes) and declines sharply by March as cranes begin their northward migration.

The increased abundance of cranes in the Delta during January and February coincides with a decline in abundance in the Chico and Butte sink areas. Pogson and Lindstedt (1988) suggest that movement of the population from the northern Sacramento Valley to the Delta may be a traditional occurrence, possibly brought on by changes in food resources or roosting habitat availability. Thus, although greater sandhill cranes winter in the Delta from October through March, they occur in the greatest abundance toward the latter portion of the wintering season.

The central Delta and the Cosumnes and Mokelumne River floodplains provide habitat for the entire Delta wintering population (Pogson and Lindstedt 1988). Delta islands considered important greater sandhill crane winter foraging and roosting habitat include Staten Island, Tyler Island, Brack Tract, and Canal Ranch. Other Delta Islands considered crane winter foraging acres include Grand Island, Terminous Tract, New Hope Tract, and Bouldin Island (Pogson and Lindstedt 1988). Cranes also use Webb Tract extensively. Isolated records of cranes suggest that cranes may also forage on adjacent Delta islands such as Bacon Island and Holland Tract.

Cranes occur primarily on suitable roosting habitat and adjacent suitable foraging areas. Roost sites are limited in the central Delta, although cornfields and wheat fields and other crane foraging habitats are abundant. Thousands of lesser and greater sandhill cranes converge each evening on the few available roost sites in the Delta provided by private duck clubs. Two important roost sites, Woodbridge Ecological Reserve and the Robin Bell property, are owned by the Department solely for the management of greater sandhill cranes.

## Western Yellow-Billed Cuckoo

The California yellow-billed cuckoo, a California-listed endangered species, is a subspecies of the yellow-billed cuckoo. The species was once common in the Western states but has been extirpated from much of its previous range including southern British Columbia, Washington, Oregon, Idaho, Utah, and Nevada (Laymon and Halterman 1987).

The cuckoo usually arrives in California in June and departs by late August or early September to winter in South America. It is considered an uncommon to rare summer resident of valley foothill and desert riparian habitats in scattered locations throughout California (Zeiner et al. 1990).

The yellow-billed cuckoo inhabits deciduous riparian thickets or forests with dense, low-level or understory foliage adjacent to slow-moving watercourses, backwaters, or seeps. Willow and cottonwood are usually dominant components of the vegetation. Within the Sacramento Valley, the cuckoo may also utilize adjacent orchards; along the Colorado River, they may inhabit mesquite thickets when willow is absent (Zeiner et al. 1990).

The cuckoo typically nests in sites with at least some willow, a dense understory of foliage, high humidity, and wooded foraging sites greater than 25 acres in area (Gaines 1977). Most eggs are laid mid-June to Mid-July with the clutch size averaging 3-4 eggs (Bent 1964).

Surveys conducted in California in 1977 estimated between 122 and 163 breeding pairs. Surveys conducted again in 1986 and 1987 estimated between 30 to 33 pairs (Laymon and Halterman 1988). This represents a 73 to 82 percent decline which is attributed to loss of riparian habitat.

## Loggerhead Shrike

Typical loggerhead shrike nesting habitat is an open field with a few trees, open woodlands, or scrub. They breed over most of North America from central Canada south to southern Mexico. The loggerhead shrike winters throughout most of the breeding range, but retreats somewhat from Canada. The loggerhead shrike feeds mostly on large insects and other land invertebrates, and also on mice, birds, lizards, and carrion. Its survival is jeopardized by habitat destruction and exposure to pesticides, and possibly from impact with cars on roads within nesting and hunting territories (Erlich et al. 1992).

The loggerhead shrike has been observed in the eastern and western Suisun Marsh. They utilize a number of different habitat types in the marsh including open fields, wetlands, uplands, and open woodlands (Brenda Grewell, DWR, pers. comm., December 1994).

## Willow Flycatcher

The willow flycatcher, a state-listed endangered species, was formally a common summer resident throughout California. The breeding range of the willow flycatcher extended wherever extensive willow thickets occurred. The species has now been eliminated as a breeding bird from most of its former range in California. Only five populations of significance remain in isolated meadows of the Sierra Nevada and along the Kern, Santa Margarita, San Luis Rey, and Santa Ynez rivers in southern California. The smallest of these consisted of about six pairs and the largest about 44 pairs. The total population estimate for California is about 200 pairs of willow flycatchers. A survey conducted in late summer 1991 on Department-owned willow riparian habitat at Red Lake, Alpine County, indicated that a significant breeding population exists there. Further study is planned.

The loss of riparian habitat is the principal reason for the decline of California's willow flycatcher population and contraction of the species' range. Impacts to habitat and breeding birds associated with livestock grazing have also been implicated in the decline of the species. Nest parasitism by brown-headed cowbirds (*Molothrus sp.*) may have contributed significantly to population reductions.

More than a decade ago, the Department designated the willow flycatcher a "Bird Species of Special Concern" of highest priority. This finding prompted several years of Department studies to further assess the status of willow flycatchers in California. Reports from the Pacific Coast and Southwest resulted in addition of the willow flycatcher to the National Audubon Society's Blue List of declined bird species in 1980 and 1986. In 1984, the willow flycatcher was added to the U.S. Forest Service, Region 5 (most comprised of the State of California) Sensitive Species list. The USFWS has also designated the willow flycatcher as a sensitive species for Region 1 (Washington, Idaho, Oregon, California, and Nevada) based on significant declines in this region. The Southwestern willow flycatcher (*E.T. extimus*), with small populations in southern California, was proposed for listing as endangered by the USFWS on July 21, 1993.

## Burrowing Owl

The burrowing owl, a California species of special concern, is a year round resident of open, dry grassland and desert habitats and can also be found in grass, forb and open shrub stages of pinyon-juniper and ponderosa pine habitats. It was formerly common in appropriate habitats throughout the state, excluding the humid northwest coastal forests and high mountains. The population of these owls has markedly decreased in recent decades due to conversion of grassland to agriculture, and poisoning of ground squirrels (Zeiner et al. 1990).

The burrowing owl's diet consists mainly of insects but will consume small mammals, reptiles, birds, and carrion. It hunts from a perch, but also hovers, hawks, dives, and hops after prey on the ground (Zeiner et al. 1990).

This owl usually nests in bare, level ground in abandoned burrows of ground squirrels or other small mammals (Verner and Boss 1980). In soft soils it may dig its own burrows and in areas where animal burrows are scarce it may use pipes, culverts, and nest boxes (Robertson 1929). The nest chamber is typically lined with excrement, pellets, debris, grass, feathers, but on occasion it may be unlined.

Throughout the day the burrowing owl moves its perching location to thermoregulate. In the early morning hours it perches in open sunlight and as the warms it will move to the shade or into the burrow (Coulombe 1971.)

Breeding occurs from March through August, with peak in April and May. Clutch size ranges between 2-10 eggs with an average of 5-6. The young emerge from the burrow at about 2 weeks of age and are able to fly by about 4 weeks. The burrowing owl is semicolonial and probably the most gregarious owl in North America.

## MAMMALS

### Riparian Woodrat

The riparian woodrat, a subspecies of the dusky-footed woodrat, is a California Species of Special Concern and previously a Federal Category 2 Candidate. The historic range of the riparian woodrat occupied the native riparian forests within the natural floodplain along the northern portion of the San Joaquin River and its tributaries from Stanislaus County to the Delta. This type of habitat had a brushy understory associated with the forest and adjacent upland areas suitable for cover and retreat from annual floods (Orr 1940). This historic range is nearly identical to the historic range of the riparian brush rabbit (Larsen 1993). Currently, the riparian woodrat and the riparian brush rabbit are known to occur only in CMSP, San Joaquin County, along the Stanislaus River (Williams and Basey 1986).

The riparian woodrat is declining in population size and appears to be in jeopardy (Williams 1986) due to loss of habitat. This loss is primarily due to the completion of dams on the main tributaries to the lower San Joaquin River system which has reduced the frequency and severity of flooding. Prior to construction of dams and levees, much of the land that periodically flooded was used as pasture and was uneven in topography with some ground remaining above typical flood levels. These higher areas contained numerous patches of shrubs and trees and probably provided refuge during flooding events. Virtually all areas outside of flood-control levees now have been cleared, leveled, and planted as orchards, vineyards, or annual row crops.

The riparian woodrat lodge is constructed of sticks and other litter in tree cavities, snags, logs, or downed woody material.

### Riparian Brush Rabbit

There are 13 recognized subspecies of brush rabbit, and eight of these occur in California. Riparian brush rabbits, a subspecies of the brush rabbit, are small brownish cottontail-like rabbits with a white belly, relatively short ears and a small inconspicuous tail. The hind legs are short and hind feet are slender and not covered with long or dense hair. The white belly and ventral tail hairs are gray near the skin, and the ears lack dark areas at the tips (Orr 1940, Ingles 1965, Chapman 1974). Adults are about 13 inches long (300-375 mm). The riparian brush rabbit can be distinguished from other subspecies by its relatively pale color, gray sides and darker back (Orr 1935), its restricted range and habit requirements, and its skull characteristics. When looking down at the head from above, their cheeks protrude outward rather than being straight or curving inward as in other subspecies (Orr 1935, 1940).

The riparian brush rabbit was first described by Orr in 1935 with the type locality designated as the west side of the San Joaquin River, two miles north of Vernalis, Stanislaus County, California.

Riparian brush rabbits forage on herbaceous vegetation, including grasses, sedges, clover, forbs, shoots, and leaves within or very close to brushy cover, usually along trails, fire breaks, or at the edge of brushy areas. They seldom venture more than several meters from brushy cover, and do not forage in large open areas. Foraging activity occurs during the early morning and early evening hours (Larsen 1993).

Home ranges are generally small, and are located within and usually shaped by the extent of available brushy areas. The average home range size has been estimated as 957 m<sup>2</sup> for males and 244 m<sup>2</sup> for females. Female home ranges overlapped slightly at the edges, but the core areas did not overlap. Brushy clumps smaller than 450 m<sup>2</sup> are rarely occupied (Larsen 1993). At Caswell Memorial State Park (CMSP), the overall population density of riparian brush rabbits at carrying capacity is estimated to be three animals per hectare (3/ha).

The breeding season of riparian brush rabbits in CMSP occurs from January to May. The gestation period is about 27 days, and three to four young are born in a shallow burrow or cavity lined with grasses and fur and covered by a plug of residual vegetation. The young have fine thin hair and their eyes are closed. They are nursed only at night, and after about 10 days their eyes open. They remain in the nest for about two weeks and continue to nurse for two more weeks after that. The young do not become reproductively active until the following breeding season. Adult females can breed again shortly after birth of a litter. They have about three to four litters during the season, with an average of nine to 16 young produced per female per year. Five out of six rabbits (*Sylvilagus* sp.) do not survive until the next breeding season, so population turnover is rapid (Larsen 1993).

The habits of dispersal are generally unknown. It is assumed that animals may travel a very short distance if necessary to find a suitable unoccupied home range within riparian habitat during the breeding season. They are closely restricted to dense brushy cover and probably are unable or unwilling to disperse through large open areas, so the riparian brush rabbit population is confined to the CMSP. Animals that are displaced farther than 350 m from their home range have extreme difficulty returning to their original territory (Larsen 1993).

Riparian brush rabbits are preyed upon by various native raptorial and carnivorous species that normally occur within the riparian habitat, such as hawks, owls, foxes, and snakes. They are also susceptible to predation by feral dogs and cats. During chance environmental events resulting in flooding or wildlife, they can suffer direct mortality.

The riparian brush rabbit is strictly associated with San Joaquin Valley riparian forests with dense brushy understory. The habitat was found within the floodplain on the valley floor in northern San Joaquin Valley. The original forest and floodplain have been cleared, altered, and degraded. The wholesale destruction of this essential habitat has resulted in the disappearance of the riparian brush rabbit from all but a very tiny portion of its historic range (Williams 1986, 1988, and 1993; Williams and Basey 1986; Basey 1990).

Riparian brush rabbits occupied the native riparian forest within the natural floodplain along the northern portion of the San Joaquin River and its tributaries from Stanislaus County to the Delta (Orr 1940). During historical times, this area had ample brushy understory associated with the forest and suitable upland areas for cover and retreat from annual floods. The riparian brush rabbit occurred within suitable habitat throughout this area (Larsen 1993).

All evidence indicates that riparian brush rabbits are now completely dependent on the remaining suitable habitat in CMSP. Recent surveys along rivers within the historic range were conducted by Williams and Basey (1986) and Basey (1990) and concluded that no riparian brush rabbits were found anywhere outside CMSP. A current census of the riparian brush rabbit population was conducted during January 1993 in CMSP by Williams (1993). The current population size is 213 to 312 individuals. The population is presently at carrying capacity at the CMSP due to the recent drought conditions. Based on the estimated historic abundance, there is only 0.23% of the original population still surviving.

During the mid 1970s and 1980s, this population drastically dropped yearly to a low of 10 to 20 individuals during flooding. In one year during the 1970s, the survivors were removed from trees and shrubs by CMSP personnel in boats and released on solid ground (Williams and Basey 1986, Basey 1990).

The major cause of decline for the riparian brush rabbit in California has been the destruction, fragmentation, and degradation of the San Joaquin Valley native riparian forest habitat within their historic range (Williams and Basey 1986, Basey 1990). In addition, the remaining riparian habitat is severely fragmented, highly disturbed, regularly subjected to prolonged flooding, and thus, is not likely to provide adequate support for viable populations of riparian brush rabbits. Even if there were suitable habitat areas, it is not possible for the animals to disperse from the Park to these fragments of habitat on their own (Larsen 1993).

Riparian brush rabbits are strictly confined to areas with dense brushy and herbaceous ground cover within riparian forests. They seldom venture more than one to two meters from brushy cover. Some large shrubs, small bushy trees, large trees, and snags must be present, along with brushy areas that are at least 460 m<sup>2</sup> in size and some raised areas with appropriate cover. Open areas and areas subject to prolonged flooding, where ground cover and litter are regularly removed and willows predominate, are not typically used by riparian brush rabbits.

Typical vegetation forming essential habitat within the riparian forest for riparian brush rabbits includes Wild Rose (*Rosa* sp.), Coyote Brush (*Baccharis* sp.), Blackberries (*Rubus* sp), Elderberries (*Sambucus* sp.). Wild Grape (*Vitus californicus*), Box Elder (*Acer negundo*), Valley Oak (*Quercus lobata*), and Cottonwoods (*Populus* sp).

Within the historic range of riparian brush rabbits, prior to any attempts to reestablish populations, extensive habitat restoration must be undertaken. This will require construction of mounds, revegetation with native habitat, and provision of cover on flood levees to provide protection during flooding. Cover must be maintained at a height of at least 21 cm for riparian brush rabbits (Williams 1988, 1993).

## PLANTS

### Rose Mallow

The habitat of the rose mallow includes river banks and freshwater marsh. The range extends along Butte Creek and the Sacramento River and adjoining sloughs from Butte County to the Delta and to San Joaquin County. The species is common in the south and central Delta: Middle River islands, Woodward Canal, West Canal, Old River near Coney Island, Grant Line Canal, and Bacon Island. In the Delta, it is confined to freshwater marsh habitat on remnant berm islands. It is associated with tules, willows, button willow, and other marsh and riparian species on heavy silt, clay, or peat soils (DWR 1992).

Its range has been diminished by channelization and draining of wetlands. In the southern Delta, levee maintenance, bank erosion, and island submergence have led to the loss of some populations of California hibiscus. Increases in channel water salinity may also pose a threat to this freshwater species. Competition from an invasive introduced iris may displace the hibiscus. The scarcity of remaining habitat prompted the special status (DWR 1992a).

### Delta Tule Pea

This climbing perennial herb was distributed historically throughout many San Francisco Bay and Delta marshlands, with additional populations known from San Benito, Fresno, and Tulare counties (Broich, Oregon State University, pers. comm.). Because of widespread habitat losses from the filling and diking of wetlands, its current distribution is largely restricted to fresh and brackish tidal wetlands bordering San Pablo and Suisun bays and tidal wetlands in the Delta. It was previously a federal candidate species.

Its current geographical range is from the Napa River to the Stockton area (CNPS 1977d). Several populations have been found in various localities of the San Joaquin Valley, although placement of these specimens in this subspecies has been questioned (Hitchcock 1952). A closely related subspecies, *L. jepsonii* ssp. *californicus*, is common along waterways throughout the State. It is distinguished from the Delta tulle-pea by the presence of small hairs on most of the plant parts (Munz and Keck 1968).

CNPS (1977d) lists marsh lands, on drier ground, as habitat of this subspecies. It is found among tulle stands in the western Suisun Marsh and Delta where it occasionally forms dense tangled masses. Most of the occurrences listed in the data base computer search had habitat descriptions such as "edge of slough" or "along river bank", implying areas of tidal influence.

All of the populations of the Delta tule-pea noted during field surveys in Suisun Marsh localities were confined to the edges and water side of levees (sometimes the crest) of tidally influenced streams. Drainage of marshy areas and salinity changes are considered as endangerment factors (CNPS 1977d).

### Suisun Aster

This robust, perennial herb, 1-2 meters tall, is known from various areas throughout Suisun Marsh and the Sacramento-San Joaquin Delta. It typically occurs along tidal sloughs in salt to brackish marshes and was previously a federal candidate species.

### Mason's Lilaepsis

Mason's lilaepsis is a member of the carrot family (Apiaceae), the fourth largest family of flowering plants in California. In 1979, Mason's lilaepsis was listed as "rare" by DFG. It was previously a federal candidate for listing. In addition, Mason's lilaepsis is in the inventory of rare and endangered plants of the California Native Plant Society (Smith and York 1984) in which it is listed as a plant of "highest priority".

Mason's lilaepsis is a low-growing perennial that appears grass-like at a distance. The leaves are reduced to hollow, obscurely septate, cylindrical phyllodes that are produced in short tufts 1.5-7 cm long and less than 1 mm wide. Flowering branches (peduncles) are shorter than the leaves. The inflorescence is a simple umbel producing 3-8 flowers.

Mason's lilaepsis is known from a minimum of 39 sites according to information from the California Natural Diversity Data Base (CNDDDB). The overall distribution of the plant includes Contra Costa, Napa, Solano, Sacramento, and San Joaquin counties.

The plant is restricted to the tidal zone and grows in disturbed muddy banks and flats and occasionally on rotting wood. Measurements taken of population positions on exposed banks determined that they occur in the zone between 16 and 36 inches (40 and 90 cm) above the high and low tide equilibrium point (i.e., above the zero flood level). The highest densities of plants were found to occur at 30 to 32 inches (75-80 cm) above tidal equilibrium.

The formation of habitat is primarily due to natural disturbance of riparian or marsh vegetation as a result of bank failure and erosion. The plants appear to colonize new habitat both vegetatively and by seed deposition. Entire plants of Mason's lilaepsis were observed floating in the Delta sloughs suggesting that vegetative reproduction and the formation of clonal populations may be important in colonization. The rhizomatous nature of Mason's lilaepsis allows it to reproduce vegetatively. It is likely that some populations are composed mostly of clones from individuals that initially colonized the habitat.

The plants grow successfully in the shade of riparian shrubs, such as willows (*Salix* spp.), and in full sunlight. No correlation between riparian or marsh species was observed for plant association preference of Mason's lilaepsis. The associated species were a function of local habitat conditions. Highly-disturbed, steeply-sloping levees supported herbaceous perennial associates. Older levees with more gentle slopes and small islands supported riparian shrubs and non-levied areas consisted primarily of tule and cattail marshlands. Mason's lilaepsis is rarely observed in association with rock revetment under conditions when siltation occurs in a manner that provides a suitable substrate.

The habitat of Mason's lilaepsis is generally considered transient. The rate of habitat formation, colonization, and eventually loss varies as a function of bank stability. Steep levee banks are unstable and the viability of a population of Mason's lilaepsis may be as short as one year after colonization. More stable situations, such as those on riparian islands, may support a population for over 20 years based on historical information obtained from topographic maps of islands in the sloughs. In summer, habitat viability is directly related to the level of human development with levied banks having low viability.

While little data are available on channel water salinity requirements, evidence suggests populations are restricted to the fresher portion of the Napa River and locations west of Martinez in the Suisun Bay area and Sacramento-San Joaquin Delta. Threats to this species are primarily related to dredging, levee construction and riprapping.

### **SPECIAL STATUS SPECIES IN PROJECT SERVICE AREAS**

A wide variety of special status plants and animals are found in the potential service areas of the Project. Appendix A of this Attachment lists those species and their location. The DFG's Annual Status Report on Threatened Species in California and the DFG's Wildlife Habitat Relationship Species Accounts can be used as more detailed references for these species. The habitats, by service area, are listed below. Impacts to these habitats facilitated by the delivery of water from the Delta Wetlands Project will affect the species listed in Appendix A.

#### **San Joaquin Valley Service Area**

Valley-foothill grassland, blue oak-foothill pine woodland, chaparral, interior Coast Range saltbush scrub, valley sink scrub, valley saltbush scrub, valley freshwater marsh, northern claypan vernal pool, and various riparian habitats, including riparian forest, woodland, and scrub (Hansen 1993).

### Central Coast Service Area

Cropland, wetland, estuary, marine habitat, riparian habitat, oak woodland, grassland, oak-foothill pine woodland, and chaparral (San Luis Obispo County 1994).

Coastal strand and marine habitats, chaparral, coastal scrub, grassland, oak woodland, pinyon-juniper woodland, conifer forest, riparian forest and woodlands, and freshwater marsh (Santa Barbara County 1994).

Cropland, riparian habitat, dune habitat, marine, grassland, coastal sage scrub, chaparral, oak woodland, pinyon-juniper woodland, conifer forest, coastal wetlands, lagoons, and subalpine forest (Ventura County 1988).

### South Coast Service Area

Subalpine conifer forest, lodgepole pine forest, white fir forest, Jeffrey pine forest, pinyon-juniper woodland, montane hardwood-conifer forest, montane hardwood forest, oak woodland, oak-foothill pine woodland, eucalyptus habitat, riparian habitat, Joshua tree woodland, alpine dwarf scrub, chaparral, chamise-redshank chaparral, coastal scrub, desert wash, desert scrub, alkali desert scrub, annual grassland, cropland, pasture, fresh emergent wetland, riverine, and open water habitats, including lacustrine and marine (Mayer and Laudenslayer 1988).

Cropland, grassland, oak woodland, pine-fir forest, chaparral, juniper-pinyon woodland, woodland-chaparral, coastal sage scrub, riparian habitat, marsh, seasonal marsh, and open water habitats associated with lakes, bays, and reservoirs (San Diego County 1993).

Grassland, coastal sage scrub, chaparral, oak savanna, southern oak woodland-forest, riparian woodland-forest, conifer-woodland-forest, marsh, and cropland (Orange County 1984).

### Southern Deserts Service Area

Chaparral, coastal sage scrub, deciduous woodlands, grasslands, wetlands, oak woodlands, conifer forest, pebble or pavement plans, white fir woodland, pinyon/juniper woodlands, Mojave desert scrub, saltbrush scrub, alkali sinks, sand dunes (San Bernardino County March 1989).

Subalpine conifer forest, lodgepole pine forest, white fir forest, Jeffrey pine forest, ponderosa pine forest, pinyon-juniper woodland, montane hardwood-conifer forest, montane hardwood forest, oak woodland, eucalyptus habitat, riparian habitat, palm oasis, Joshua tree woodland, alpine dwarf scrub, chaparral, chamise-redshank chaparral, coastal scrub, desert

succulent scrub, desert wash, desert scrub, alkali desert scrub, annual grassland, fresh emergent wetland, pasture, riverine, lacustrine, orchard, and cropland (Mayer and Laudenslayer 1988).

Desert scrub, succulent scrub, sand dune habitat, pinyon-juniper woodland, mixed chaparral, montane hardwood conifer forest, alkali desert scrub, cropland, freshwater/saltwater marsh, desert riparian habitat, and desert wash (Imperial County 1993).

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**APPENDIX A**

**STATE-LISTED ENDANGERED OR THREATENED SPECIES  
IN SERVICE AREAS OF THE DELTA WETLANDS PROJECT  
THAT COULD BE DIRECTLY OR INDIRECTLY AFFECTED  
BY THE PROPOSED DELTA WETLANDS PROJECT.**

STATE-LISTED ENDANGERED OR THREATENED SPECIES AND  
SPECIAL STATUS SPECIES IN SERVICE AREAS OF THE DELTA  
WETLANDS PROJECT THAT COULD BE DIRECTLY OR INDIRECTLY  
AFFECTED BY THE PROPOSED DELTA WETLANDS PROJECT.

<u>Species</u>	BIRDS	<u>Status</u>
1. California condor <i>Gymnogyps californianus</i>		SE, FE
2. Bald eagle <i>Haliaeetus leucocephalus</i>		SE, FT
3. American peregrine falcon <i>Falco peregrinus anatum</i>		SE, FE
4. Light-footed clapper rail <i>Rallus longirostris levipes</i>		SE, FE
5. California least tern <i>Sterna antillarum browni</i>		SE, FE
6. Least Bell's vireo <i>Vireo bellii pusillus</i>		SE, FE
7. Belding's savannah sparrow <i>Passerculus sandwichensis beldingi</i>		SE, 1/
8. California brown pelican <i>Pelecanus occidentalis californicus</i>		SE, FE
9. California horned lark <i>Eremophila alpestris actia</i>		1/
10. Ferruginous hawk <i>Buteo regalis</i>		1/
11. Mountain plover <i>Charadrius montanus</i>		1/

12. Southwestern willow flycatcher <i>Empidonax traillii extimus</i>	FPE
13. California gnatcatcher <i>Poliopitila californica</i>	FT
14. Southern California rufous-crowned sparrow <i>Aimophila ruficeps canescens</i>	1/
15. Bell's sage sparrow <i>Amphispiza belli belli</i>	1/

#### MAMMALS

<u>Species</u>	<u>Status</u>
1. San Joaquin antelope squirrel <i>Ammospermophilus nelsoni</i>	ST, 1/
2. Mohave ground squirrel <i>Spermophilus mohavensis</i>	ST
3. Morro Bay kangaroo rat <i>Dipodomys heermanni morroensis</i>	SE, FE
4. Giant kangaroo rat <i>Dipodomys ingens</i>	SE, FE
5. Stephens' kangaroo rat <i>Dipodomys stephensi</i>	ST, FE
6. Fresno kangaroo rat <i>Dipodomys nitratooides exilis</i>	SE, FE
7. Tipton kangaroo rat <i>Dipodomys nitratooides nitratooides</i>	SE, FE
8. San Joaquin kit fox <i>Vulpes macrotis mutica</i>	ST, FE
9. Townsend's western big-eared bat <i>Plecotus townsendii townsendii</i>	1/

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|--|----|
| 10. Greater western mastiff bat<br><i>Eumops perotis californicus</i>              | 1/ |
| 11. Short nosed kangaroo rat<br><i>Dipodomys nitratoides brevinasus</i>            | 1/ |
| 12. California leaf-nosed bat<br><i>Macrotus californicus</i>                      | 1/ |
| 13. Arizona myotis<br><i>Myotis lucifugus occultus</i>                             | 1/ |
| 14. California mastiff bat<br><i>Eumops perotis californicus</i>                   | 1/ |
| 15. San Diego black-tailed jackrabbit<br><i>Lepus californicus bennettii</i>       | 1/ |
| 16. San Bernardino flying squirrel<br><i>Glaucomys sabrinus californicus</i>       | 1/ |
| 17. Dulzura (California) pocket mouse<br><i>Chaetodipus californicus femoralis</i> | 1/ |
| 18. Northwestern San Diego pocket mouse<br><i>Chaetodipus fallax fallax</i>        | 1/ |
| 19. San Bernardino Merriam's kangaroo rat<br><i>Dipodomys merriami parvus</i>      | 1/ |
| 20. Tehachapi pocket mouse<br><i>Perognathus alticola inexpectatus</i>             | 1/ |
| 21. Yuma mountain lion<br><i>Felis concolor browni</i>                             | 1/ |

FISHES

<u>Species</u>	<u>Status</u>
1. Unarmored threespine stickleback <i>Gasterosteus aculeatus williamsoni</i>	SE, FE
2. Mohave tui chub <i>Gila bicolor mohavensis</i>	SE, FE

AMPHIBIANS

<u>Species</u>	<u>Status</u>
1. Tehachapi slender salamander <i>Batrachoceps stebbinsi</i>	ST
2. Foothill yellow-legged frog <i>Rana boyllii</i>	1/

REPTILES

<u>Species</u>	<u>Status</u>
1. Coachella Valley fringe-toed lizard <i>Uma inornata</i>	SE, FT
2. Blunt-nosed leopard lizard <i>Gambelia silus</i>	SE, FE
3. Alameda whipsnake <i>Masticophis lateralis euryxanthus</i>	ST, FPE
4. Giant garter snake <i>Thamnophis couchii gigas</i>	ST, FT
5. Southern rubber boa <i>Charina bottae umbratica</i>	ST, 1/

6. San Diego horned lizard <i>Phrynosoma coronatum blainvillii</i>	1/
7. Southern sagebrush lizard <i>Sceloporus graciosus vadenburgianus</i>	1/
8. Coastal western whiptail <i>Cnemidophorus tigris multiscutatus</i>	1/
9. Coastal rosy boa <i>Lichamura trivirgata rosafusca</i>	1/
10. San Bernardino ringneck snake <i>Diadophis punctatus modestus</i>	1/
11. California mountain kingsnake <i>Lampropeltis zonata pulchra</i>	1/
12. Northern red diamond rattlesnake <i>Crotalus ruber ruber</i>	1/

#### INSECTS

<u>Species</u>	<u>Status</u>
1. San Joaquin dune beetle <i>Coelus gracilis</i>	1/
2. Ciervo aegialian scarab beetle <i>Aegialia concinna</i>	1/

#### PLANTS

<u>Species</u>	<u>Status</u>
1. Succulent owl's-clover <i>Orthocarpus campestris</i> var <i>succulentus</i>	SE, 1/
2. Hairy Orcutt grass <i>Orcuttia pilosa</i>	SE, FPE

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|---|---------|
| 3. San Joaquin Valley Orcutt grass<br><i>Orcuttia inaequalis</i>              | SE, FPE |
| 4. Colusa grass<br><i>Neostapfia colusana</i>                                 | SE, FPT |
| 5. Merced clarkia<br><i>Clarkia lingulata</i>                                 | SE, 1/  |
| 6. Coastal Dunes milk vetch<br><i>Astragalus tener var titi</i>               | SE, 1/  |
| 7. Slender-horned spineflower<br><i>Centrostegia leptoceras</i>               | SE, FE  |
| 8. Nevin's barberry<br><i>Mahonia nevinii</i>                                 | SE, 1/  |
| 9. Thread-leaved brodiaea<br><i>Brodiaea filifolia</i>                        | SE, 1/  |
| 10. Santa Ana River woollystar<br><i>Eriastrum densifolium ssp. sanctorum</i> | SE, FE  |
| 11. Bakersfield saltbush<br><i>Atriplex tularensis</i>                        | SE, 1/  |
| 12. Tulare pseudobahia<br><i>Pseudobahia peirsonii</i>                        | SE, FPE |
| 13. Hearst's manzanita<br><i>Arctostaphylos hookeri ssp. hearstiorum</i>      | SE, 1/  |
| 14. Indian knob mountainbalm<br><i>Eriodictyon altissimum</i>                 | SE, FPE |
| 15. Nipoma mesa lupine<br><i>Lupinus nipomensis</i>                           | SE, 1/  |
| 16. Sacramento Orcutt grass<br><i>Orcuttia viscida</i>                        | SE, FPE |
| 17. Crampton's tuctoria<br><i>Tuctoria mucronata</i>                          | SE, FE  |

18. Indian Valley brodiaea <i>Brodiaea coronaria</i> ssp. <i>rosea</i>	SE, 1/
19. Kaweah brodiaea <i>Brodiaea insignis</i>	SE, 1/
20. Striped adobe lily <i>Fritillaria striata</i>	ST, 1/
21. Pitkin Marsh Indian paintbrush <i>Castilleja uliginosa</i>	SE, 1/
22. Slough thistle <i>Cirsium crassicaule</i>	1/
23. Dunn's mariposa lily <i>Calochortus dunnii</i>	SR, 1/
24. Conejo buckwheat <i>Eriogonum crocatum</i>	SR, 1/
25. Mexican flannelbush <i>Fremontodendron mexicanum</i>	SR, 1/
26. Santa Susana tarplant <i>Hemizonia minthornii</i>	SR, 1/
27. Santa Ynez false-lupine <i>Thermopsis macrophylla</i> var <i>aqnina</i>	SR, 1/
28. Parish's checkerbloom <i>Sidalcea hickmanii</i> ssp. <i>parishii</i>	SR, 1/
29. Red rock tarplant <i>Hemizonia arida</i>	SR, 1/
30. Dwarf goldenstar <i>Bloomeria humilis</i>	SR, 1/
31. Hearst's ceanothus <i>Ceanothus hearstiorum</i>	SR, 1/
32. Maritime ceanothus <i>Ceanothus maritimus</i>	SR, 1/

33. Pismo clarkia <i>Clarkia speciosa ssp. immaculata</i>	SR, FPE
34. Dudley's lousewort <i>Pedicularis dudleyi</i>	SR, 1/
35. Adobe sanicle <i>Sanicula maritima</i>	SR, 1/
36. Cuesta Pass checkerbloom <i>Sidalcea hickmanii ssp. anomala</i>	SR, 1/
37. Recurved larkspur <i>Delphinium recurvatum</i>	1/
38. California jewelflower <i>Caulanthus californicus</i>	SE, FE

SE = State endangered;                      ST = State threatened;                      FE = Federally endangered;  
 1/ = Previous Federal candidate species    FPE = Federally proposed endangered;  
 FPT = Federally proposed threatened;    FT = Federally threatened;                      SR = State rare

FW98g771.wpd/ef

**ATTACHMENT 5**

**CONSERVATION EASEMENTS**

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Conservation Easements

5-1

Revised CESA Biological Opinion  
Delta Wetlands Project/August 6, 1998  
[2090-1995-085-2]

**C - 0 6 3 1 0 4**

C-063104

**RECORDING REQUESTED BY:**

Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

**MAIL TO:**

Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

Space Above Line for Recorder's Use Only

**CONSERVATION EASEMENT DEED**

THIS CONSERVATION EASEMENT DEED is made this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_ by Delta Wetlands ("Grantor"), in favor of THE STATE OF CALIFORNIA ("Grantee"), acting by and through its Department of Fish and Game, a subdivision of the California Resources Agency, with reference to the following facts:

**RECITALS**

A. Grantor is the sole owner in fee simple of certain real property located on Bouldin Island in the County of San Joaquin, State of California, more particularly described in Exhibit "A" attached hereto and incorporated by this reference (the "Property");

B. The Property possesses wildlife and habitat values (collectively, "Conservation Values") of great importance to Grantee, the people of the State of California;

C. The Property provides high quality habitat for wintering wildlife such as ducks, geese, and swans, upland game birds, wintering and resident songbirds, and small mammals, and habitat for special status species such as the Swainson's hawk and greater sandhill crane;

D. The Department of Fish and Game has jurisdiction, pursuant to the Fish and Game Code Section 1802, over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of those species, and the Department of Fish and Game is authorized to hold easements for these purposes pursuant to Civil Code Section 815.3, Fish and Game Code Section 1348, and other provisions of California law; and

E. This Conservation Easement provides mitigation for certain impacts of the Delta Wetlands Project located in the counties of Contra Costa and San Joaquin, State of California, pursuant to a California Endangered Species Act Biological Opinion dated August 6, 1998 and Habitat Management Plan, dated September 1995.

### COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

In consideration of the above recitals and the mutual covenants, terms, conditions, and restrictions contained herein, and pursuant to California law, including Civil Code Section 815, *et seq.*, Grantor hereby voluntarily deeds and conveys to Grantee a conservation easement in perpetuity over the Property.

1. Purpose. The purpose of this Conservation Easement is to provide protection of the Conservation Values of the Property, to prevent any use of the Property that will significantly impair or interfere with the Conservation Values of the Property, to improve, preserve, and protect wintering waterfowl habitat and habitat for resident and migratory songbirds in order to offset a portion of the loss of wintering waterfowl and resident and migratory songbird habitat values, caused by the Delta Wetlands Project in the Sacramento-San Joaquin Delta. Towards that end, it is the Grantor's intention that this Conservation Easement will confine the use of the Property to such activities, including without limitation, those involving the preservation and enhancement of native species and their habitat in a manner consistent with the habitat conservation purposes of this Conservation Easement and the use of the Property for the production of crops, recreation, hunting and wildlife habitat management practices as set forth herein and contained in the Habitat Management Plan (HMP), dated September 1995 which are consistent with the maintenance and protection of wintering waterfowl and resident and migratory songbird habitat.

2. Grantee's Rights. To accomplish the purposes of this Conservation Easement, Grantor hereby grants and conveys the following rights to Grantee by this Conservation Easement Deed:

(a) To preserve and protect the conservation values of the Property;

(b) To enter upon the Property at reasonable times in order to monitor Grantor's compliance with and to otherwise enforce the terms of this Conservation Easement and for scientific research and interpretive purposes by Grantee or its designees, provided that Grantee shall not unreasonably interfere with Grantor's use and quiet enjoyment of the Property;

(c) To prevent any activity on or use of the Property that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features of the Property that may be damaged by any act, failure to act, or any use that is inconsistent with the purposes of this Conservation Easement;

(d) All present and future development rights except as described in the DEIR/EIS.

3. Prohibited Uses. Any activity on or use of the Property inconsistent with the purposes of this Conservation Easement is prohibited. Without limiting the generality of the foregoing, the following uses by Grantor, Grantor's agents, and third parties, are expressly prohibited:

(a) Any activity that, in Grantee's reasonable judgment, would have an adverse impact on the Conservation Easement or materially affects the protections of the HMP, except as otherwise expressly provided herein.

(b) The division, subdivision or de facto subdivision of the Property, without the prior written consent of Grantee.

(c) Conversion of any portion of the Property into asparagus, vineyards, or orchards.

(d) Any agricultural practice not expressly permitted herein or in the HMP which physically impedes the use of the Property by wildlife particularly waterfowl, including, but not limited to, the use of trellises or plastic mulching, and the use of any devices intended to harass or injure waterfowl. The term "agricultural practice" does not include any practice related to the hunting activities permitted herein.

(e) The filling, excavating, extracting, dredging, mining, drilling for or removal of topsoil, sand, gravel, rock, geothermal resources, oil, gas, hydrocarbons, minerals, or other materials on or below the surface of the Property that are inconsistent with the HMP or materially affect the protections of the HMP, except such filling and removal of materials from the surface as may be permitted hereunder in connection with the provisions of the HMP.

(f) The building of roads or trails, that are inconsistent with the HMP or materially affect the protections of the HMP.

(g) The operation of any motorcycles, trail bikes or other motor-driven or motor-powered land vehicles off existing roads, that are inconsistent with the HMP or materially affect the protections of the HMP.

(h) The disposal or dumping of agrichemicals, biocides, trash, garbage or other unsightly, offensive or toxic material.

(i) The construction or placement of any buildings, mobile homes, camping facilities, fences, signs, billboards or commercial advertising material or any other structures

of any kind, unless such structure replaces a preexisting structure of similar size, bulk, and height except as described in the DEIR/EIS.

(j) The use or storage of biocides and/or other agrichemicals, in a manner inconsistent with the HMP .

(k) The introduction of exotic plant or animal species, that are inconsistent with the HMP or materially affect the protections of the HMP.

(l) Any alteration or manipulation of natural water courses which might, in the Grantee's judgment, materially adversely affect the Conservation Easement except for customary Reclamation District activities.

(m) The installation of utility structures or lines, except as permitted in the HMP or as described in the DEIR/EIS.

(n) Livestock grazing in the habitat areas.

4. Grantor's Duties. Grantor shall undertake all reasonable actions to prevent the unlawful entry and trespass by persons whose activities may degrade or harm the conservation values of the Property. In addition, Grantor shall undertake all necessary actions to perfect Grantee's rights under section 2 of this Conservation Easement, including but not limited to, Grantee's water rights.

5. Reserved Rights. Grantor reserves to itself, and to its personal representatives, heirs, successors, and assigns, all rights accruing from its ownership of the Property, including the right to engage in or to permit or invite others to engage in all uses of the Property that are consistent with the purposes of this Conservation Easement.

6. Grantee's Remedies. If Grantee determines that Grantor is in violation of the terms of this Conservation Easement or that a violation is threatened, Grantee shall give written notice to Grantor of such violation and demand in writing the cure of such violation. If Grantor fails to cure the violation within fifteen (15) days after receipt of said written notice and demand from Grantee, or said cure reasonably requires more than fifteen (15) days to complete and Grantee fails to begin the cure within the fifteen (15) day period or fails to continue diligently to complete the cure, Grantee may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by Grantor with the terms of this Conservation Easement, to recover any damages to which Grantee may be entitled for violation by Grantor of the terms of this Conservation Easement, to enjoin the violation, *ex parte* as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies, or for other

equitable relief, including, but not limited to, the restoration of the Property to the condition in which it existed prior to any such violation or injury. Without limiting Grantor's liability therefor, Grantee may apply any damages recovered to the cost of undertaking any corrective action on the Property.

If Grantee, in its sole discretion, determines that circumstances require immediate action to prevent or mitigate significant damage to the conservation values of the Property, Grantee may pursue its remedies under this paragraph without prior notice to Grantor or without waiting for the period provided for cure to expire. Grantee's rights under this paragraph apply equally to actual or threatened violations of the terms of this Conservation Easement. Grantor agrees that Grantee's remedies at law for any violation of the terms of this Conservation Easement are inadequate and that Grantee shall be entitled to the injunctive relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Grantee may be entitled, including specific performance of the terms of this Conservation Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Grantee's remedies described in this section shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity, including but not limited to, the remedies set forth in Civil Code Section 815, *et seq.*, inclusive.

If at any time in the future Grantor or any subsequent transferee uses or threatens to use such lands for purposes inconsistent with this Conservation Easement, notwithstanding Civil Code Section 815.7, the California Attorney General or any entity or individual with a justiciable interest in the preservation of this Conservation Easement has standing as interested parties in any proceeding affecting this Conservation Easement.

6.1 Costs of Enforcement. Any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, but not limited to, costs of suit and attorneys' fees, and any costs of restoration necessitated by Grantor's violation or negligence under the terms of this Conservation Easement shall be borne by Grantor.

6.2 Grantee's Discretion. Enforcement of the terms of this Conservation Easement by Grantee shall be at the discretion of Grantee, and any forbearance by Grantee to exercise its rights under this Conservation Easement in the event of any breach of any term of this Conservation Easement by Grantor shall not be deemed or construed to be a waiver by Grantee of such term or of any subsequent breach of the same or any other term of this Conservation Easement or of any of Grantee's rights under this Conservation Easement. No delay or omission by Grantee in the exercise of any right or remedy upon any breach by Grantor shall impair such right or remedy or be construed as a waiver.

6.3 Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury to or change in the Property resulting from causes beyond Grantor's control, including,

without limitation, fire, flood, storm, and earth movement, or from any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the Property resulting from such causes.

6.4 Department of Fish and Game Right of Enforcement. All rights and remedies conveyed to Grantee under this Conservation Easement Deed shall extend to and are enforceable by the Department of Fish and Game.

7. Fences, Gates and Other Protective Measures. Grantor shall take proper action to install and/or maintain adequate measures to protect the conservation values of the Property, including but not limited to, fences, gates, canals, ditches, and levees.

8. Access. This Conservation Easement does not convey a general right of access to the public.

9. Costs and Liabilities. Grantor retains all responsibilities and shall bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Property.

9.1 Taxes. Grantor shall pay before delinquency all taxes, assessments, fees, and charges of whatever description levied on or assessed against the Property by competent authority (collectively "taxes"), including any taxes imposed upon, or incurred as a result of, this Conservation Easement, and shall furnish Grantee with satisfactory evidence of payment upon request.

9.2 Hold Harmless. Grantor shall hold harmless, indemnify, and defend Grantee and its, directors, officers, employees, agents, contractors, and representatives (collectively "Indemnified Parties") from and against all liabilities, penalties, costs, losses, damages, expenses, causes of action, claims, demands, or judgments, including without limitation, reasonable attorneys' fees, arising from or in any way connected with: (1) injury to or the death of any person, or physical damages to any property, resulting from any act, omission, condition, or other matter related to or occurring on or about the Property, regardless of cause, unless due to the negligence of any of the Indemnified Parties; (2) the obligations specified in Sections 4, 9, and 9.1; and (3) the existence or administration of this Conservation Easement.

9.3 Condemnation. The purposes of the Conservation Easement are presumed to be the best and most necessary public use as defined at Civil Procedure Code Section 1240.680 notwithstanding Civil Procedure Code Sections 1240.690 and 1240.700.

10. Assignment. This Conservation Easement is transferable, but Grantee may assign its rights and obligations under this Conservation Easement only to an entity or organization authorized to acquire and hold conservation easements pursuant to Civil Code Section 815.3. Grantee shall require the assignee to record the assignment in the county where the property is located.

11. Subsequent Transfers. Grantor agrees to incorporate the terms of this Conservation Easement in any deed or other legal instrument by which Grantor divests itself of any interest in all or a portion of the Property, including, without limitation, a leasehold interest. Grantor further agrees to give written notice to Grantee of the intent to transfer of any interest at least fifteen (15) days prior to the date of such transfer. Grantee shall have the right to prevent subsequent transfers in which prospective subsequent claimants or transferees are not given notice of the covenants, terms, conditions and restrictions of this Conservation Easement. The failure of Grantor or Grantee to perform any act provided in this section shall not impair the validity of this Conservation Easement or limit its enforceability in any way.

12. Notices. Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Grantor: Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

To Grantee: California Department of Fish and Game  
Bay-Delta and Special Water Projects Division  
4001 North Wilson Way  
Stockton, California 95205

General Counsel  
Department of Fish and Game  
Legal Affairs Division  
1416 Ninth Street, 12th Floor  
Sacramento, California 95814-2090

or to such other address as either party shall designate by written notice to the other. Notice shall be deemed effective upon delivery in the case of personal delivery or, in the case of delivery by first class mail, five (5) days after deposit into the United States mail.

13. Extinguishment. This Conservation Easement may be extinguished by Grantor and Grantee by mutual written agreement upon the request of either party only after the requesting party acquires and records a perpetual conservation easement in the name of the State of California at an alternative location, which provides conservation values that satisfy the specific mitigation purposes of this Conservation Easement as stated in Paragraph E.

14. Amendment. This Conservation Easement may be amended by Grantor and Grantee by mutual written agreement. Any such amendment shall be consistent with the purposes of this Conservation Easement and, except as provided in Section 13, shall not affect its perpetual duration. Any such amendment shall be recorded in the official records of San Joaquin County, State of California.

15. General Provisions.

(a) Controlling Law. The interpretation and performance of this Conservation Easement shall be governed by the laws of the State of California.

(b) Liberal Construction. Any general rule of construction to the contrary notwithstanding, this Conservation Easement shall be liberally construed in favor of the deed to effect the purpose of this Conservation Easement and the policy and purpose Civil Code Section 815, *et seq.* If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purposes of this Conservation Easement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability. If a court of competent jurisdiction voids or invalidates on its face any provision of this Conservation Easement Deed, such action shall not affect the remainder of this Conservation Easement Deed. If a court of competent jurisdiction voids or invalidates the application of any provision of this Conservation Easement to Deed to a person or circumstance, such action shall not affect the application of the provision to other persons or circumstances.

(d) Entire Agreement. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings, or agreements relating to the Conservation Easement. No alteration or variation of this instrument shall be valid or binding unless contained in an amendment in accordance with Section 14.

(e) No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors. The covenants, terms, conditions, and restrictions of this

Conservation Easement Deed shall be binding upon, and inure to the benefit of, the parties hereto and their respective personal representatives, heirs, successors, and assigns and shall continue as a servitude running in perpetuity with the Property.

(g) Termination of Rights and Obligations. A party's rights and obligations under this Conservation Easement terminate upon transfer of the party's interest in the Conservation Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Captions The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon construction or interpretation.

(i) Counterparts. The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

IN WITNESS WHEREOF Grantor and Grantee have entered into this Conservation Easement the day and year first above written.

GRANTOR:  
Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

Approved as to form:

BY: \_\_\_\_\_  
Authorized Representative

BY: \_\_\_\_\_  
LINUS MASOUREDIS, General Counsel  
California Department of Fish and  
Game

CERTIFICATE OF ACCEPTANCE

This is to certify that the interest in real property conveyed by the Conservation Easement Deed by \_\_\_\_\_, dated \_\_\_\_\_, to the State of California, grantee, acting by and through its Department of Fish and Game (the "Department"), a governmental agency (under Government Code section 27281), is hereby accepted by the undersigned officer on behalf of the Department, pursuant to authority conferred by resolution of the California Fish and Game Commission on \_\_\_\_\_.

GRANTEE:  
STATE OF CALIFORNIA, by and  
through,  
DEPARTMENT OF FISH AND GAME

By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Authorized Representative  
Date: \_\_\_\_\_

**RECORDING REQUESTED BY:**

Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

**MAIL TO:**

Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

Space Above Line for Recorder's Use Only

**CONSERVATION EASEMENT DEED**

THIS CONSERVATION EASEMENT DEED is made this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_ by Delta Wetlands ("Grantor"), in favor of THE STATE OF CALIFORNIA ("Grantee"), acting by and through its Department of Fish and Game, a subdivision of the California Resources Agency, with reference to the following facts:

**RECITALS**

- A. Grantor is the sole owner in fee simple of certain real property located on Holland Tract in the County of Contra Costa, State of California, more particularly described in Exhibit "A" attached hereto and incorporated by this reference (the "Property");
- B. The Property possesses wildlife and habitat values (collectively, "Conservation Values") of great importance to Grantee, the people of the State of California;
- C. The Property provides high quality habitat for wintering wildlife such as ducks, geese, and swans, upland game birds, wintering and resident songbirds, and small mammals, and habitat for special status species such as the Swainson's hawk and greater sandhill crane;
- D. The Department of Fish and Game has jurisdiction, pursuant to the Fish and Game Code Section 1802, over the conservation, protection, and management of fish, wildlife, native plants and the habitat necessary for biologically sustainable populations of those species, and the Department of Fish and Game is authorized to hold easements for these purposes pursuant to Civil Code Section 815.3, Fish and Game Code Section 1348, and other provisions of California law; and

E. This Conservation Easement provides mitigation for certain impacts of the Delta Wetlands Project located in the counties of Contra Costa and San Joaquin, State of California, pursuant to a California Endangered Species Act Biological Opinion dated August 6, 1998 and Habitat Management Plan, dated September 1995.

### COVENANTS, TERMS, CONDITIONS AND RESTRICTIONS

In consideration of the above recitals and the mutual covenants, terms, conditions, and restrictions contained herein, and pursuant to California law, including Civil Code Section 815, *et seq.*, Grantor hereby voluntarily deeds and conveys to Grantee a conservation easement in perpetuity over the Property.

1. Purpose. The purpose of this Conservation Easement is to provide protection of the Conservation Values of the Property, to prevent any use of the Property that will significantly impair or interfere with the Conservation values of the Property, to improve, preserve, and protect wintering waterfowl habitat and habitat for resident and migratory songbirds in order to offset a portion of the loss of wintering waterfowl and resident and migratory songbird habitat values, caused by the Delta Wetlands Project in the Sacramento-San Joaquin Delta. Towards that end, it is the Grantor's intention that this Conservation Easement will confine the use of the Property to such activities, including without limitation, those involving the preservation and enhancement of native species and their habitat in a manner consistent with the habitat conservation purposes of this Conservation Easement and the use of the Property for the production of crops, recreation, hunting and wildlife habitat management practices as set forth herein and contained in the Habitat Management Plan (HMP), dated September 1995 which are consistent with the maintenance and protection of wintering waterfowl and resident and migratory songbird habitat.

2. Grantee's Rights. To accomplish the purposes of this Conservation Easement, Grantor hereby grants and conveys the following rights to Grantee by this Conservation Easement Deed:

(a) To preserve and protect the conservation values of the Property;

(b) To enter upon the Property at reasonable times in order to monitor Grantor's compliance with and to otherwise enforce the terms of this Conservation Easement and for scientific research and interpretive purposes by Grantee or its designees, provided that Grantee shall not unreasonably interfere with Grantor's use and quiet enjoyment of the Property;

(c) To prevent any activity on or use of the Property that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features of the Property that may be damaged by any act, failure to act, or any use that is inconsistent with the purposes of this Conservation Easement;

(d) All present and future development rights except as described in the DEIR/EIS.

3. Prohibited Uses. Any activity on or use of the Property inconsistent with the purposes of this Conservation Easement is prohibited. Without limiting the generality of the foregoing, the following uses by Grantor, Grantor's agents, and third parties, are expressly prohibited:

(a) Any activity that, in Grantee's reasonable judgment, would have an adverse impact on the Conservation Easement, except as otherwise expressly provided herein.

(b) The division, subdivision or de facto subdivision of the Property, without the prior written consent of Grantee.

(c) Conversion of any portion of the Property into asparagus, vineyards, or orchards.

(d) Any agricultural practice not expressly permitted herein or in the HMP which physically impedes the use of the Property by wildlife particularly waterfowl, including, but not limited to, the use of trellises or plastic mulching, and the use of any devices intended to harass or injure waterfowl. The term "agricultural practice" does not include any practice related to the hunting activities permitted herein.

(e) The filling, excavating, extracting, dredging, mining, drilling for or removal of topsoil, sand, gravel, rock, geothermal resources, oil, gas, hydrocarbons, minerals, or other materials on or below the surface of the Property that are inconsistent with the HMP or materially affect the protections of the HMP, except such filling and removal of materials from the surface as may be permitted hereunder in connection with the provisions of the HMP.

(f) The building of roads or trails, that are inconsistent with the HMP or materially affect the protections of the HMP.

(g) The operation of any motorcycles, trail bikes or other motor-driven or motor-powered land vehicles off existing roads, that are inconsistent with the HMP or materially affect the protections of the HMP.

(h) The disposal or dumping of agrichemicals, biocides, trash, garbage or other unsightly, offensive or toxic material.

(i) The construction or placement of any buildings, mobile homes, camping facilities, fences, signs, billboards or commercial advertising material or any other structures of any kind, unless such structure replaces a preexisting structure of similar size, bulk, and height except as described in the DEIR/EIS.

(j) The use or storage of biocides and/or other agrichemicals, in a manner inconsistent with the HMP .

(k) The introduction of exotic plant or animal species, except as provided in the HMP.

(l) Any alteration or manipulation of natural water courses which might, in the Grantee's judgment, materially adversely affect the Conservation Easement except for customary Reclamation District activities.

(m) The installation of utility structures or lines, except as permitted in the HMP or as described in the DEIR/EIS.

(n) Livestock grazing in the habitat areas.

4. Grantor's Duties. Grantor shall undertake all reasonable actions to prevent the unlawful entry and trespass by persons whose activities may degrade or harm the conservation values of the Property. In addition, Grantor shall undertake all necessary actions to perfect Grantee's rights under section 2 of this Conservation Easement, including but not limited to, Grantee's water rights.

5. Reserved Rights. Grantor reserves to itself, and to its personal representatives, heirs, successors, and assigns, all rights accruing from its ownership of the Property, including the right to engage in or to permit or invite others to engage in all uses of the Property that are consistent with the purposes of this Conservation Easement.

6. Grantee's Remedies. If Grantee determines that Grantor is in violation of the terms of this Conservation Easement or that a violation is threatened, Grantee shall give written notice to Grantor of such violation and demand in writing the cure of such violation. If Grantor fails to cure the violation within fifteen (15) days after receipt of said written notice and demand from Grantee, or said cure reasonably requires more than fifteen (15) days to complete and Grantee fails to begin the cure within the fifteen (15) day period or fails to continue diligently to complete the cure, Grantee may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by Grantor with the terms of this Conservation Easement, to recover any damages to which Grantee may be entitled for violation by Grantor of the terms of this Conservation Easement, to enjoin the violation, *ex parte* as necessary, by temporary or permanent injunction without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies, or for other equitable relief, including, but not limited to, the restoration of the Property to the condition in which it existed prior to any such violation or injury. Without limiting Grantor's liability

therefor, Grantee may apply any damages recovered to the cost of undertaking any corrective action on the Property.

If Grantee, in its sole discretion, determines that circumstances require immediate action to prevent or mitigate significant damage to the conservation values of the Property, Grantee may pursue its remedies under this paragraph without prior notice to Grantor or without waiting for the period provided for cure to expire. Grantee's rights under this paragraph apply equally to actual or threatened violations of the terms of this Conservation Easement. Grantor agrees that Grantee's remedies at law for any violation of the terms of this Conservation Easement are inadequate and that Grantee shall be entitled to the injunctive relief described in this section, both prohibitive and mandatory, in addition to such other relief to which Grantee may be entitled, including specific performance of the terms of this Conservation Easement, without the necessity of proving either actual damages or the inadequacy of otherwise available legal remedies. Grantee's remedies described in this section shall be cumulative and shall be in addition to all remedies now or hereafter existing at law or in equity, including but not limited to, the remedies set forth in Civil Code Section 815, *et seq.*, inclusive.

If at any time in the future Grantor or any subsequent transferee uses or threatens to use such lands for purposes inconsistent with this Conservation Easement, notwithstanding Civil Code Section 815.7, the California Attorney General or any entity or individual with a justiciable interest in the preservation of this Conservation Easement has standing as interested parties in any proceeding affecting this Conservation Easement.

6.1 Costs of Enforcement. Any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, but not limited to, costs of suit and attorneys' fees, and any costs of restoration necessitated by Grantor's violation or negligence under the terms of this Conservation Easement shall be borne by Grantor.

6.2 Grantee's Discretion. Enforcement of the terms of this Conservation Easement by Grantee shall be at the discretion of Grantee, and any forbearance by Grantee to exercise its rights under this Conservation Easement in the event of any breach of any term of this Conservation Easement by Grantor shall not be deemed or construed to be a waiver by Grantee of such term or of any subsequent breach of the same or any other term of this Conservation Easement or of any of Grantee's rights under this Conservation Easement. No delay or omission by Grantee in the exercise of any right or remedy upon any breach by Grantor shall impair such right or remedy or be construed as a waiver.

6.3 Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury to or change in the Property resulting from causes beyond Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken by Grantor under emergency conditions to prevent, abate, or mitigate significant injury to the

Property resulting from such causes.

6.4 Department of Fish and Game Right of Enforcement. All rights and remedies conveyed to Grantee under this Conservation Easement Deed shall extend to and are enforceable by the Department of Fish and Game.

7. Fences, Gates and Other Protective Measures. Grantor shall take proper action to install and/or maintain adequate measures to protect the conservation values of the Property, including but not limited to, fences, gates, canals, ditches, and levees.

8. Access. This Conservation Easement does not convey a general right of access to the public.

9. Costs and Liabilities. Grantor retains all responsibilities and shall bear all costs and liabilities of any kind related to the ownership, operation, upkeep, and maintenance of the Property.

9.1 Taxes. Grantor shall pay before delinquency all taxes, assessments, fees, and charges of whatever description levied on or assessed against the Property by competent authority (collectively "taxes"), including any taxes imposed upon, or incurred as a result of, this Conservation Easement, and shall furnish Grantee with satisfactory evidence of payment upon request.

9.2 Hold Harmless. Grantor shall hold harmless, indemnify, and defend Grantee and its, directors, officers, employees, agents, contractors, and representatives (collectively "Indemnified Parties") from and against all liabilities, penalties, costs, losses, damages, expenses, causes of action, claims, demands, or judgments, including without limitation, reasonable attorneys' fees, arising from or in any way connected with: (1) injury to or the death of any person, or physical damages to any property, resulting from any act, omission, condition, or other matter related to or occurring on or about the Property, regardless of cause, unless due to the negligence of any of the Indemnified Parties; (2) the obligations specified in Sections 4, 9, and 9.1; and (3) the existence or administration of this Conservation Easement.

9.3 Condemnation. The purposes of the Conservation Easement are presumed to be the best and most necessary public use as defined at Civil Procedure Code Section 1240.680 notwithstanding Civil Procedure Code Sections 1240.690 and 1240.700.

10. Assignment. This Conservation Easement is transferable, but Grantee may assign its rights and obligations under this Conservation Easement only to an entity or organization authorized to acquire and hold conservation easements pursuant to Civil Code Section 815.3. Grantee shall require the assignee to record the assignment in the county where the property is located.

11. Subsequent Transfers. Grantor agrees to incorporate the terms of this Conservation Easement in any deed or other legal instrument by which Grantor divests itself of any interest in all or a portion of the Property, including, without limitation, a leasehold interest. Grantor further agrees to give written notice to Grantee of the intent to transfer of any interest at least fifteen (15) days prior to the date of such transfer. Grantee shall have the right to prevent subsequent transfers in which prospective subsequent claimants or transferees are not given notice of the covenants, terms, conditions and restrictions of this Conservation Easement. The failure of Grantor or Grantee to perform any act provided in this section shall not impair the validity of this Conservation Easement or limit its enforceability in any way.

12. Notices. Any notice, demand, request, consent, approval, or communication that either party desires or is required to give to the other shall be in writing and be served personally or sent by first class mail, postage prepaid, addressed as follows:

To Grantor: Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

To Grantee: California Department of Fish and Game  
Bay-Delta and Special Water Projects Division  
4001 North Wilson Way  
Stockton, California 95205

General Counsel  
Department of Fish and Game  
Legal Affairs Division  
1416 Ninth Street, 12th Floor  
Sacramento, California 95814-2090

or to such other address as either party shall designate by written notice to the other. Notice shall be deemed effective upon delivery in the case of personal delivery or, in the case of delivery by first class mail, five (5) days after deposit into the United States mail.

13. Extinguishment. This Conservation Easement may be extinguished by Grantor and Grantee by mutual written agreement upon the request of either party only after the requesting party acquires and records a perpetual conservation easement in the name of the State of California at an alternative location, which provides conservation values that satisfy the specific mitigation purposes of this Conservation Easement as stated in Paragraph E.

14. Amendment. This Conservation Easement may be amended by Grantor and Grantee by mutual written agreement. Any such amendment shall be consistent with the purposes of this Conservation Easement and, except as provided in Section 13, shall not affect its perpetual duration. Any such amendment shall be recorded in the official records of Contra Costa County, State of California.

15. General Provisions.

(a) Controlling Law. The interpretation and performance of this Conservation Easement shall be governed by the laws of the State of California.

(b) Liberal Construction. Any general rule of construction to the contrary notwithstanding, this Conservation Easement shall be liberally construed in favor of the deed to effect the purpose of this Conservation Easement and the policy and purpose Civil Code Section 815, *et seq.* If any provision in this instrument is found to be ambiguous, an interpretation consistent with the purposes of this Conservation Easement that would render the provision valid shall be favored over any interpretation that would render it invalid.

(c) Severability. If a court of competent jurisdiction voids or invalidates on its face any provision of this Conservation Easement Deed, such action shall not affect the remainder of this Conservation Easement Deed. If a court of competent jurisdiction voids or invalidates the application of any provision of this Conservation Easement to Deed to a person or circumstance, such action shall not affect the application of the provision to other persons or circumstances.

(d) Entire Agreement. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings, or agreements relating to the Conservation Easement. No alteration or variation of this instrument shall be valid or binding unless contained in an amendment in accordance with Section 14.

(e) No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

(f) Successors. The covenants, terms, conditions, and restrictions of this Conservation Easement Deed shall be binding upon, and inure to the benefit of, the parties

hereto and their respective personal representatives, heirs, successors, and assigns and shall continue as a servitude running in perpetuity with the Property.

(g) Termination of Rights and Obligations. A party's rights and obligations under this Conservation Easement terminate upon transfer of the party's interest in the Conservation Easement or Property, except that liability for acts or omissions occurring prior to transfer shall survive transfer.

(h) Captions The captions in this instrument have been inserted solely for convenience of reference and are not a part of this instrument and shall have no effect upon construction or interpretation.

(i) Counterparts. The parties may execute this instrument in two or more counterparts, which shall, in the aggregate, be signed by both parties; each counterpart shall be deemed an original instrument as against any party who has signed it. In the event of any disparity between the counterparts produced, the recorded counterpart shall be controlling.

IN WITNESS WHEREOF Grantor and Grantee have entered into this Conservation Easement the day and year first above written.

GRANTOR:  
Delta Wetlands Properties  
3697 Mt. Diablo Boulevard  
Suite 100  
Lafayette, California 94549  
Attention: Project Director

Approved as to form:

BY: \_\_\_\_\_  
Authorized Representative

BY: \_\_\_\_\_  
LINUS MASOUREDIS, General Counsel  
California Department of Fish and  
Game

CERTIFICATE OF ACCEPTANCE

This is to certify that the interest in real property conveyed by the Conservation Easement Deed by \_\_\_\_\_, dated \_\_\_\_\_, to the State of California, grantee, acting by and through its Department of Fish and Game (the "Department"), a governmental agency (under Government Code section 27281), is hereby accepted by the undersigned officer on behalf of the Department, pursuant to authority conferred by resolution of the California Fish and Game Commission on \_\_\_\_\_.

GRANTEE:  
STATE OF CALIFORNIA, by and  
through,  
DEPARTMENT OF FISH AND GAME

By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Authorized Representative  
Date: \_\_\_\_\_

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**ATTACHMENT 6**

**MISCELLANEOUS DATA  
AND INFORMATION  
FOR THE DELTA WETLANDS PROJECT  
BIOLOGICAL OPINION**

**METHOD USED TO CALCULATE  
HABITAT ISLAND DISCHARGE CREDITS  
FOR RPM 2.4.2 IN THE DFG'S CESA BIOLOGICAL OPINION**

	February	March	April	May	June	Total
Discharges off of the Habitat Islands(TAF) <sup>1/</sup>	2.3	2.2	0.7	0.3	0	5.5
Diversions onto the Habitat Islands(TAF) <sup>2/</sup>	1.1	0	0	0.4	3.0	-4.5
					Net Habitat Island Discharges (TAF)	1TAF

**CESA HABITAT ISLAND CREDIT =  $\frac{1 \text{ TAF}}{2} = 0.5 \text{ TAF}$**

<sup>1/</sup> If discharges in the February through June period are less than shown, the HIC may be decreased.

<sup>2/</sup> If diversions in the February through June period are less than shown, the HIC may increased.

**ILLUSTRATIONS OF METHOD USED TO CALCULATE  
THE NET  
HABITAT ISLAND CREDIT (HIC) AND AVAILABLE FOC ENVIRONMENTAL  
WATER**

**Example 1 (using operations model output for 1971)<sup>Δ</sup>**

	Dec.	Jan.	Feb.	March	April	May	June
10 % of discharges for export (TAF)	0	0	9.5	0	0.2	0	0
Cumulative Discharges	0	0	9.5	9.5	9.7	9.7	0
Discharge off of the habitat islands (TAF)	N/A	N/A	2.3	2.2	0.7	0.3	0
Diversions onto the habitat islands (TAF)	N/A	N/A	1.1	0	0	0.4	3.0
Net Cumulative HIC (TAF) <sup>Δ</sup>	0	0	1.2	3.4	4.1	4.0	-3.0 <sup>Δ</sup>
Cumulative FOC Environmental Water Available (TAF) <sup>Δ</sup>	0	0	8.3	6.1	5.6	0	0 <sup>Δ</sup>
FOC Environmental Water Released (TAF)	0	0	0	0	0	5.7	0

<sup>Δ</sup> For the purpose of this example any FOC environmental water available in May will be released in May.

5.7 TAF would be released in May

Example 2 (using operations model output for 1932)<sup>B/</sup>

	Dec.	Jan.	Feb.	March	April	May	June
10 % of discharges for export (TAF)	0	0	0	6.5	1.2	0	0
Cumulative Discharges	0	0	0	6.5	7.7	7.7	0
Discharge off of the Habitat Islands(TAF)	N/A	N/A	2.3	2.2	0.7	0.3	0
Diversions onto the Habitat Islands(TAF)	N/A	N/A	1.1	0	0	0.4	3.0
Net Cumulative HIC (TAF) <sup>1/</sup>	0	0	1.2	3.4	4.1	4.0	-3.0 <sup>3/</sup>
Cumulative FOC Environmental Water Available (TAF) <sup>2/</sup>	0	0	0	3.1	3.6	0	0 <sup>4/</sup>
FOC Environmental Water Released (TAF)	0	0	0	0	0	3.7	0

<sup>B/</sup> For the purpose of this example any FOC environmental water available in May will be released in May.

3.7 TAF would be released in May

Example 3 (using operations model output for 1954)<sup>c</sup>

	Dec.	Jan.	Feb.	March	April	May	June
10 % of discharges for export (TAF)	3.4	0	0	0	0	1.1	0.2
Cumulative Discharges	3.4	3.4	3.4	3.4	3.4	4.5	0.2
Discharge off of the Habitat Islands(TAF)	N/A	N/A	2.3	2.2	0.7	0.3	0
Diversions onto the Habitat Islands(TAF)	N/A	N/A	1.1	0	0	0.4	3.0
Net Cumulative HIC (TAF) <sup>1/</sup>	0	0	1.2	3.4	4.1	4.0	3.0 <sup>2/</sup>
Cumulative FOC Environmental Water Available (TAF) <sup>2/</sup>	3.4	3.4	2.2	0	0	0	0 <sup>2/</sup>
FOC Environmental Water Released (TAF)	0	0	0	0	0	0.5	0.2

<sup>c</sup> For the purpose of this example any FOC environmental water available in May will be released in May and any FOC environmental water available in June will be released in June.

0.5 TAF would be released in May and 0.2 TAF in June

Example 4 (using operations model output for 1964)<sup>D/</sup>

	Dec.	Jan.	Feb.	March	April	May	June
10 % of discharges for export (TAF)	6.2	0	0.7	0	1.2	0.9	0
Cumulative Discharges	6.2	6.2	6.9	6.9	8.1	0.9	0
Discharge off of the Habitat Islands(TAF)	N/A	N/A	2.3	2.2	0.7	0.3	0
Diversions onto the Habitat Islands(TAF)	N/A	N/A	1.1	0	0	0.4	3.0
Net Cumulative HIC (TAF) <sup>1/</sup>	0	0	1.2	3.4	4.1	-0.1	-3.0 <sup>3/</sup>
Cumulative FOC Environmental Water Available (TAF) <sup>2/</sup>	6.2	6.2	5.7	3.5	0	0	0 <sup>4/</sup>
FOC Environmental Water Released (TAF)	0	0	0	0	4.0	0.9	0

<sup>D/</sup> For the purpose of this example any FOC environmental water available in April will be released in April and any FOC environmental water available in May will be released in May.

4.0 TAF would be released in April and 0.9 TAF in May

<sup>1/</sup> Value displayed is the monthly net HIC quantity. Actual net HIC quantity will be calculated on a cumulative/daily basis from February through June. Once the HIC is applied toward discharges to calculate cumulative FOC environmental water, the calculations of discharges off of and onto the habitat islands will start at zero until applied again or June 30 of the water year, whichever occurs first.

<sup>2/</sup> Value displayed is the cumulative FOC environmental water available at the end of the month, assuming no releases are made. Actual amount available will be determined on a daily basis.

<sup>3/</sup> If the cumulative net flow quantity over the February through June period is less than zero, the amount of FOC Environmental Water available is not affected.

<sup>4/</sup> FOC Environmental Water, if available in June, will need to be released in June rather than being made available for the following month since any FOC Environmental Water not used by June 30 in any water year must be returned to Delta Wetlands.

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UNITED STATES DEPARTMENT OF COMMERCE  
 National Oceanic and Atmospheric Administration  
 NATIONAL MARINE FISHERIES SERVICE  
 Southwest Region  
 501 West Ocean Boulevard, Suite 4200  
 Long Beach, California 90802-4213  
 TEL (310) 980-4000; FAX (310) 980-4018

OCT 26 1995

F/5703:GRS

Mr. Jim Monroe  
 Chief, Sacramento/San Joaquin Delta Offices  
 Department of the Army  
 U. S. Army Engineer District, Sacramento  
 Corps of Engineers  
 1425 J Street  
 Sacramento, California 95814-2932

Dear Mr. Monroe:

Thank you for providing the National Marine Fisheries Service (NMFS) with the opportunity to comment on the Biological Assessment (BA) entitled: "Impacts of the Delta Wetlands Project on Fish Species."

General Comments on the Project Description

The Delta Wetlands (DW) project description outlines a wide range of project flexibility from providing DW discharge for export to the State Water Project (SWP) and Central Valley Project (CVP) to providing DW discharge for Delta outflow. Phrases such as "DW could cross", or "uncertain at times", or "most likely", or "may be sold or used" are used frequently in the BA's description of project operations. Specific operations in any particular water year are vague. Potential effects to the endangered Sacramento River winter-run chinook salmon could also range widely from beneficial to adverse depending on project operations and the destination of DW discharges.

The BA describes the DW project as designed to operate within the objectives of the State Water Resources Control Board (SWRCB) 1995 Water Quality Control Plan (WQCP) developed for the SWP and CVP. However, project alternative 1 requires a modification to the total delta inflow formula and project alternative 2 requires an exemption from the WQCP "percent inflow" export limit. The 1995 WQCP was developed to address the permits and licenses of the Bureau of Reclamation (Bureau) and the California Department of Water Resources (CDWR) to appropriate water. Since the DW project falls outside the scope of the existing water right and the normal coordinated operation of the CVP and SWP, the SWRCB may choose to set additional or alternative terms and conditions upon diversions and discharges by the DW project.

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Although the SWP and CVP export facilities are described as integral components of the DW project, the Bureau and DWR have not participated in the development of the project proposal or committed to the purchase of DW discharges. Thus, incorporation of DW project operations into SWP/CVP operations is unclear and uncertain at present. NMFS will require more specific information regarding CVP and SWP operations from the Bureau and DWR to fully assess the potential effects of DW project water that is sold or "wheeled" through the existing Delta export facilities.

### General Comments on the Impact Assessment for Winter-run Chinook

The BA relies on the use of a mortality index to evaluate the potential effects of Delta flow diversions and patterns on survival of juvenile winter-run chinook salmon during migration through the Delta. In the "Impact Assessment" section of the BA, mortality values are presented several times without being referred to as indices. It is important to note that the values generated by the Jones & Stokes model are not predictive of actual levels of mortality and that these indices are valid for comparison purposes only.

In addition, the mortality indices generated by the Jones & Stokes model may significantly underestimate the level of mortality for several reasons:

1) The model assumes that juvenile salmon that continue down the Sacramento River below Georgiana Slough are not affected by DW or SWP/CVP operations. Fisheries investigations by the U.S. Fish and Wildlife Service have shown that juvenile salmon released in the Sacramento River at Hyde and in the lower San Joaquin River at Jersey Point are effected by SWP/CVP export operations. Therefore, the population at risk is likely to exceed the levels evaluated in the model because the geographic area of influence is broader than the area identified in the model.

2) The mortality model assumes all juvenile salmon are actively migrating through the Delta to the sea without regard to their time of arrival. By doing so, the model does not address the cumulative effects on rearing juvenile salmon. Juvenile winter-run chinook salmon which arrive in the Delta during the fall and early winter months are likely to reside in Delta waterways for several months. These fish will be subject to any and all adverse conditions created by DW operations until they undergo smoltification and emigration from the Delta during the early spring. The model may significantly underestimate mortality rates by assuming all fish in the area of risk have been entrained or emigrated after 10 days.

3) The Jones & Stokes model assumes the Delta Cross Channel gates are closed continuously from November 1 through late May.

The 1995 WQCP provides for a total of 45 days of gate closure between November 1 and January 31. Thus, the number of fish which are diverted off the Sacramento River into the central Delta and subsequently lost due to project operations will be greater than estimated in the EA.

4) The DeltasOS model simulates monthly DW operations and Delta hydrological conditions. However, daily conditions can vary widely from the monthly averages generated by the model. Juvenile chinook salmon will be responding to the daily and, even, hourly hydrological conditions in Delta. Large losses of fish may occur during brief periods of adverse hydrological conditions.

#### Specific Comments

Page 1-3, Delta Export Demands, 2nd paragraph. At this time, the buyers or potential uses of the DW water are unknown, making the project description incomplete and analysis of the project effects difficult.

Page 1-3, Delta Water Quality Needs, 1st paragraph. Although the EA indicates the DW project could increase the supply of high-quality water for environmental benefits including Delta outflow, this type of operational scenario is not described in project Alternatives 1 or 2.

Page 2-6, Habitat Island Diversions and Discharges. It is unclear if habitat island water diversions and discharges are designed to operate within the 1995 WQCP or any other operational criteria.

Page 5-15, Cumulative Impacts, 2nd paragraph. Pursuant to the February 10, 1993, biological opinion issued by NMFS for winter-run chinook salmon, the Bureau maintains suitable habitat conditions (e.g. temperatures and flow) in the upper Sacramento River and a minimum carryover storage level in Shasta Reservoir. Thus, upstream conditions in the Sacramento River are likely to improve, rather than deteriorate, in future years for winter-run chinook salmon.

Page 5-16, Cumulative Impacts, 4th paragraph. The DW project could also result in reservoir water stored for a reduced period of time. Reservoir releases may increase earlier in the season, because DW water would be available for use later in the year. Reduced reservoir levels over the summer and fall months could result in adverse temperature conditions for spawning salmon and steelhead trout.

Page 5-16, Summary of Potential Fishery Effects of the DW Project, Seasonal Effects, Foreign Agricultural Diversions. There is little overlap between the timing of the juvenile

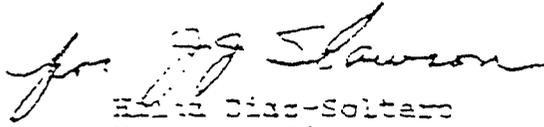
winter-run chinook salmon outmigration and the irrigation season for Delta agriculture. Thus, there would be little benefit for winter-run chinook salmon associated with the elimination of these diversions.

Summary

The information provided in the EA is inadequate for the completion of formal section 7 consultation with NMFS for the endangered winter-run chinook salmon. However, meetings between my staff, Jones & Stokes, and the DW project have provided a significant amount of new information which should facilitate the successful completion of consultation. NMFS will continue to work with the DW project and their consultants to clarify the project description and further assessment of potential project effects on the endangered winter-run chinook salmon.

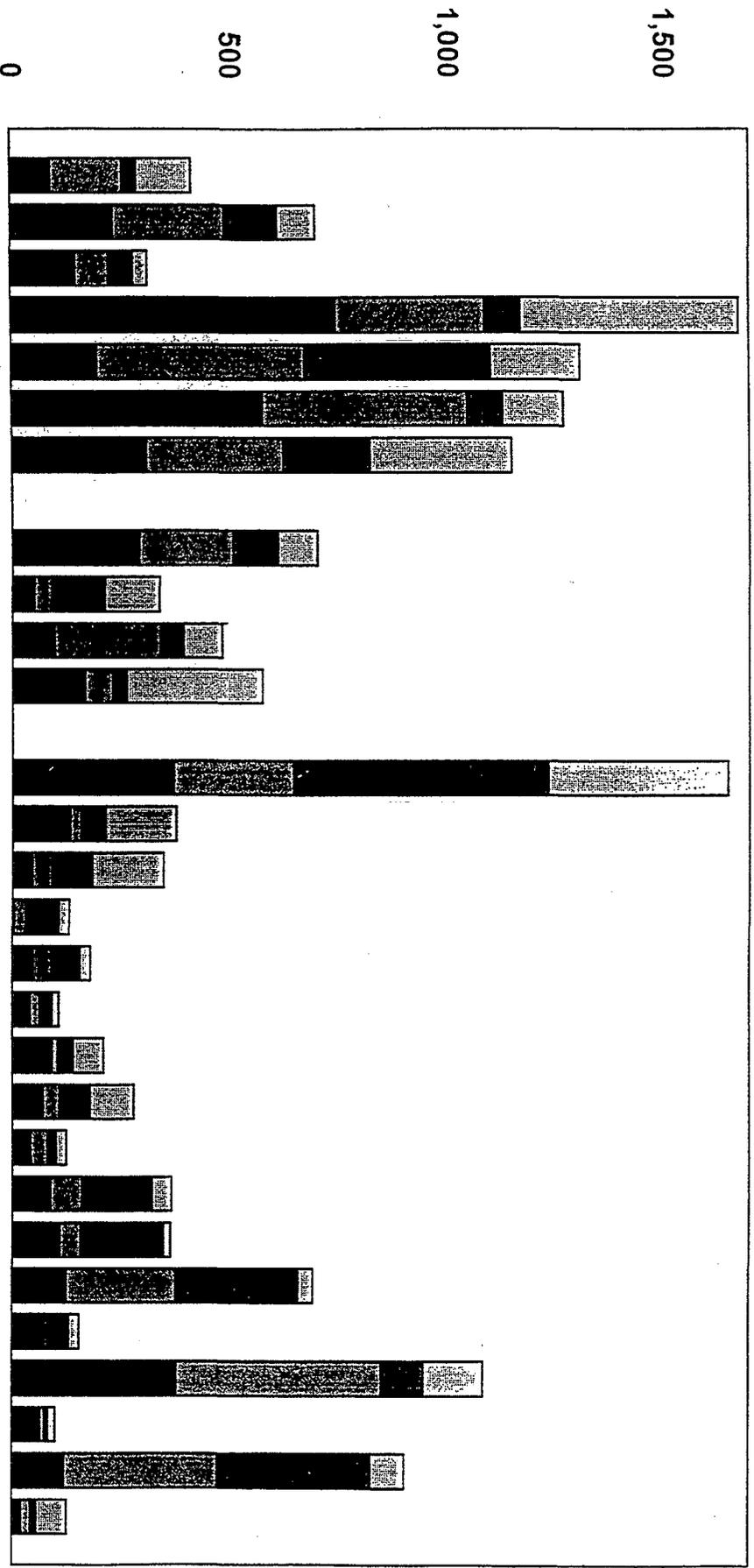
If you have any questions about these comments please call Ms. Penny Ruvelas at (707) 578-7513.

Sincerely,

  
James Sims-Solters  
Regional Director

cc: Robert Fine, USFWS  
Debra McKee, CDFG  
Dale Sweetman, CDFG  
Ken Bogdan, Jones and Stokes Associates.

# Delta Smelt Fall Midwa Trawl Abundance Index



Year	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Index	414.9	696.7	315.6	1677.6	1305.9	1287.0	145.9	0.0	697.8	337.9	479.5	571.6	0.0	1651.4	375.0	346.0	132.3	181.6	109.2	211.9	280.2	126.2	366.2	363.4	689.1	156.8	1079.4	101.2	898.7	128.3
Dec	125.2	88.7	33.7	509.9	207.7	142.3	327.4		91.3	125.0	87.8	308.9		422.9	161.1	162.0	24.3	24.2	16.9	70.9	100.1	24.8	45.5	16.6	35.0	24.3	139.4	17.8	76.1	71.6
Nov	31.1	119.9	55.3	83.1	427.7	81.1	198.2		102.3	120.9	51.7	31.1		586.2	54.2	91.8	77.9	66.6	28.0	33.8	69.5	19.1	157.9	187.6	279.0	57.5	94.3	6.8	350.6	13.1
Oct	165.2	253.4	76.8	343.0	473.1	472.0	312.4		213.7	42.2	242.5	64.7		273.7	27.3	47.4	28.0	43.7	23.6	15.1	39.6	40.7	74.7	49.7	249.2	3.5	470.0	11.8	349.6	23.0
Sep	93.4	234.7	149.8	741.6	197.4	571.6	307.9		290.5	49.8	97.5	166.9		368.6	132.4	44.8	2.1	47.0	40.7	92.1	71.0	41.6	88.1	109.5	125.9	71.5	375.7	64.8	120.4	20.6

Table A1-8. Estimated Monthly Water Budget Terms for DW Islands

	Month												Annual Total (inches)	Contributing Area (acres)	Annual Volume (TAF)
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP			
<b>DW Project Islands Intensified Agricultural Use</b>															
Rainfall (inches)	0.8	2.2	2.6	3.2	2.5	2.7	1.2	0.4	0.1	0.1	0.1	0.4	16.3	17,000	23
Soil moisture (inches)	4.0	5.1	7.1	8.0	8.0	8.0	6.5	4.0	4.0	4.0	4.0	4.0			
Lowlands evapotranspiration (inches)	1.4	1.1	0.6	0.7	1.5	2.1	2.7	3.8	4.9	5.8	4.3	2.3	31.2	17,000	44
Seepage (inches)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	12.0	17,000	17
Salt leaching water (inches)	0.0	0.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	17,000	9
Applied water (inches)	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.9	9.5	11.3	8.3	3.9	36.1	17,000	51
Drainage water (inches)	1.6	1.0	1.0	4.6	4.0	3.6	1.0	1.9	5.8	6.7	5.2	2.9	39.2	17,000	56
<b>DW Project Islands Wildlife Habitat Use</b>															
Water and marsh (acres)	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060	1,060			
Flooded area (acres)	2,000	3,400	5,000	4,500	4,300	1,400	500	0	0	0	0	1,200			
Irrigated area (acres)	5,000	3,600	2,000	2,500	2,700	5,600	6,500	7,000	7,000	7,000	7,000	5,800			
Rainfall (inches)	0.8	2.2	2.6	3.2	2.5	2.7	1.2	0.4	0.1	0.1	0.1	0.4	16.3		
Water evaporation (inches)	3.7	1.7	0.9	1.0	1.9	3.4	5.1	6.9	7.9	9.0	8.0	5.9	55.4		
Lowlands evapotranspiration (inches)	1.4	1.1	0.6	0.7	1.5	2.1	2.7	3.8	4.9	5.8	4.3	2.3	31.2		
Soil moisture	4.0	5.1	7.1	8.0	8.0	8.0	6.5	4.0	4.0	4.0	4.0	4.0			
Seepage volume (TAF)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			6
Change in flooded volume (TAF)	0.8	1.4	1.6	(0.5)	(0.2)	(2.9)	(0.9)	(0.5)	0.0	0.0	0.0	1.2			0
Net evaporation (TAF)	1.0	(0.2)	(0.9)	(1.3)	(0.5)	(0.1)	0.5	1.1	3.5	4.1	3.1	2.0			12
Applied water (TAF)	1.9	1.7	1.9	0.2	1.1	0.0	0.0	0.4	3.0	3.6	2.6	2.7			19
Drainage water (TAF)	0.6	1.0	1.7	2.5	2.3	2.2	0.7	0.3	0.0	0.0	0.0	0.0			11

Notes: Flooded depth is assumed to average 1 foot.

Drainage is assumed to be at least 50% of previous month's flooded volume for circulation.

Long-term average monthly rainfall is assumed; variations from year to year will occur.

Soil moisture is assumed to supply water for evapotranspiration or store excess rainfall.

Rainfall plus seepage plus applied water minus the change in soil moisture minus evaporation minus ET will equal the drainage.