Sacramento River Flood Control System Evaluation
Initial Appraisal Report - Upper Sacramento Area

Attachment C

Environmental Evaluation
May 1995

ENVIRONMENTAL EVALUATION

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION PHASE V
INITIAL APPRAISAL REPORT

UPPER SACRAMENTO AREA

May 1995

prepared by
Environmental Resources Branch, Planning Division
U.S. Army Engineer District, Sacramento
Corps of Engineers

C-103947

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ENVIRONMENTAL EVALUATION

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION PHASE V
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UPPER SACRAMENTO AREA

TABLE OF CONTENTS

SECTION		PAGE
1.0	Introduction	1
2.0	Scope of Analysis	1
3.0	Authorization	1
4.0	Project Location	2
5.0	Alternatives	2
5.1	No Action	5
5.2	Construction of a Cutoff Wall	5
5.3	Construction of a Sloping Drain and Stabilizing Berm or Stabilizing Berm Only	5
5.4	Levee Crown Restoration	5
5.5	Levee Crown Restoration and Construction of a Stabilizing Berm	5
5.6	Levee Crown Restoration, Construction of a Stabilizing Berm, and Mix With Lime Treatment	7
5.7	Reconstruction Plan	7
6.0	Existing Environment	10
6.1	Environmental Setting	10
6.1.1	Hydrology	10
6.1.2	Climate	10
6.1.3	Topography	11
6.1.4	Geology	11
6.1.5	Soils	11
6.1.6	Hazardous, Toxic, and Radiological Waste	11
6.2	Affected Environment	12
6.2.1	Air Quality	12
6.2.2	Water Quality	13
6.2.3	Land Use	13
6.2.4	Fish	13
6.2.5	Vegetation	15
6.2.6	Wildlife	17
6.2.7	Cultural Resources	17
6.2.8	Rare, Threatened, and Endangered Species	19
7.0	Evaluation of Impacts	22
7.1	Air Quality	22
7.2	Water Quality	22
7.3	Land Use	23
7.4	Fish	24
7.5	Vegetation and Wildlife	25
7.6	Cultural Resources	30
7.7	Rare, Threatened, and Endangered Species	31
8.0	Mitigation	32
8.1	Air Quality	32
8.2	Water Quality	33

TABLE OF CONTENTS - continued

8.3 Land Use 33
8.4 Fish 33
8.5 Vegetation and Wildlife 33
8.6 Cultural Resources 35
8.7 Rare, Threatened, and Endangered Species 35
9.0 Future Studies 36
10.0 List of Preparers 38
11.0 Literature Cited 39

FIGURES

1. Sacramento River Flood Control System Evaluation 3
2. Study Area 4
3. Levee Embankment Reconstruction Alternatives 6
4. Proposed Work Sites, Sacramento River Flood Control System Evaluation, Phase V 8

TABLES

1. Listed and Proposed Endangered, Threatened, and Candidate Species that May Occur in the Study Area 20
2. Existing and New Easements for Each Construction Site 24
3. FWS's Estimates of Impacts, Mitigation, and Costs for Each Construction Site 28

APPENDIXES

A Species Letter from FWS
B Draft Planning Aid Report for the Sacramento River Flood Control System Evaluation, Phase V

1.0 **Introduction**. The Sacramento District Corps of Engineers (Corps) is conducting a study of the Sacramento River Flood Control Project levees. The study was initiated after the 1986 flood, when sloughing of the levee slope, landside seepage, and boils occurred in the study area. Subsequent engineering evaluations indicate that levees in the project area do not meet existing design requirements and do not provide the congressionally authorized design conditions.

The evaluation of the Sacramento River Flood Control Project levees has been divided into five phases. The first phase concentrated on the levees in the Sacramento Urban Area. The Initial Appraisal Report was completed for the Sacramento Urban Area in 1988, and construction of remedial repairs began in 1990. An environmental assessment was prepared for the first phase, and the finding of no significant impact was signed on July 9, 1990. A programmatic environmental impact statement (EIS) and environmental impact report (EIR) was completed in June 1992 for the remaining four phases to comply with the requirements of the National Environmental Policy Act and the California Environmental Quality Act (Corps, 1992b). The programmatic EIS/EIR was filed with the Environmental Protection Agency in June 1992, and a Record of Decision was filed in November 1992. During the design process, when site-specific information was available, a supplemental environmental document has been prepared for each of the other phases (phases II-IV). The non-Federal project sponsor is The Reclamation Board of the State of California.

2.0 **Scope of Analysis**. This environmental evaluation is intended to provide baseline information on fish and wildlife resources in the project area. The environmental evaluation also provides a general assessment of potential impacts of project alternatives and associated mitigation costs for project impacts for inclusion in the Initial Appraisal Report. Included in this analysis are a description of the environmental setting for the study area, fisheries, wildlife, vegetation, and cultural resources and identification of threatened or endangered species in the study area. Information included in this evaluation was obtained from the programmatic EIS/EIR, the Planning Aid Report by U.S. Fish and Wildlife Service (FWS, 1995), and brief field visits.

3.0 **Authorization**. The Sacramento River Flood Control Project was originally authorized by the Flood Control Act of 1917. The present evaluation of the Sacramento River Flood Control System was authorized and funded as part of the Energy and Water Development Appropriation Act of 1987 (Public Law 99-591). Authorization for the Sacramento River Flood Control System Evaluation was contained in the Conference Report accompanying the Energy and Water Development Appropriation Act, 1987. Similar language is contained in both the House of Representatives and Senate versions of the Report. The House of Representatives Report states:

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Inspection of Completed Works: Sacramento River Flood Control Project, California. - The Committee has included $600,000 for a comprehensive analysis of the long-term integrity of the flood control system for the Sacramento River and its tributaries in collaboration with the State of California. The Committee is aware that even before the recent flooding, regional flood control officials felt the need for a thorough survey of the system. While it did serve well in the floods and prevented billions of dollars in damages, under stress it validated concerns that in many places remedial work is necessary as soon as possible, as may be enhanced levels of protection. The Corps is directed to report back to the Committee on protection enhancement requirements which it encounters in the review of the project.

The Senate Report states:

Inspection of Completed Works, Sacramento River Flood Control Project, CA. - The Committee is aware of the need for a comprehensive analysis of the integrity of the flood control system for the Sacramento River and its tributaries. Given the importance of this flood protection system, the Committee believes that such an analysis is warranted.

4.0 **Project Location**. The Sacramento River Flood Control Project consists of over 1,000 miles of levees, overflow weirs, and flood bypass channels (Figure 1). The Upper Sacramento Area includes about 315 miles of project levees along the west bank of the Sacramento River from Tisdale Bypass to Knights Landing Ridge Cut; Federal levees on the Sacramento River from Tisdale Bypass north to Vina; and levees along Cherokee Canal, Butte Creek, Elder Creek, Sycamore Creek, Mud Creek, Deer Creek, and the east bank of the Colusa Basin Drain. Of the 315 miles of levee in the project area, about 12.4 miles of levee reconstruction are recommended, as shown in Figure 2.

5.0 **Alternatives**. The purpose of this study is to examine the existing flood control system as designed and to develop a levee reconstruction plan that restores the integrity of the flood control system for the Sacramento River and its tributaries. Because technical studies determined that the existing levee structures do not meet current design requirements, alternatives were developed that address these inadequacies. The alternatives being considered for reconstruction would generally involve work on the levee crown, landside levee slope, and landward of the levee toe.

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Sacramento River Flood Control System Evaluation

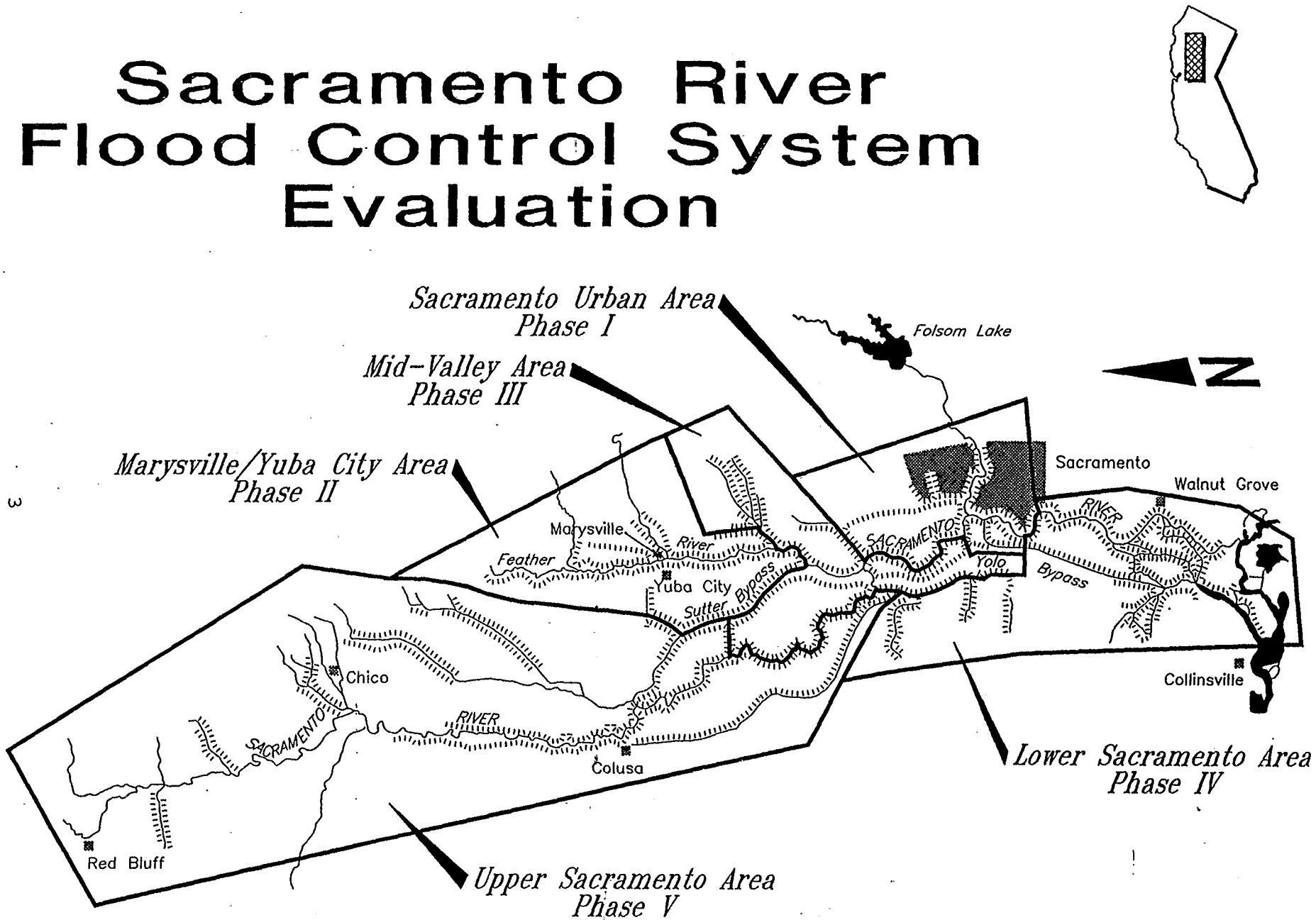

FIGURE 1

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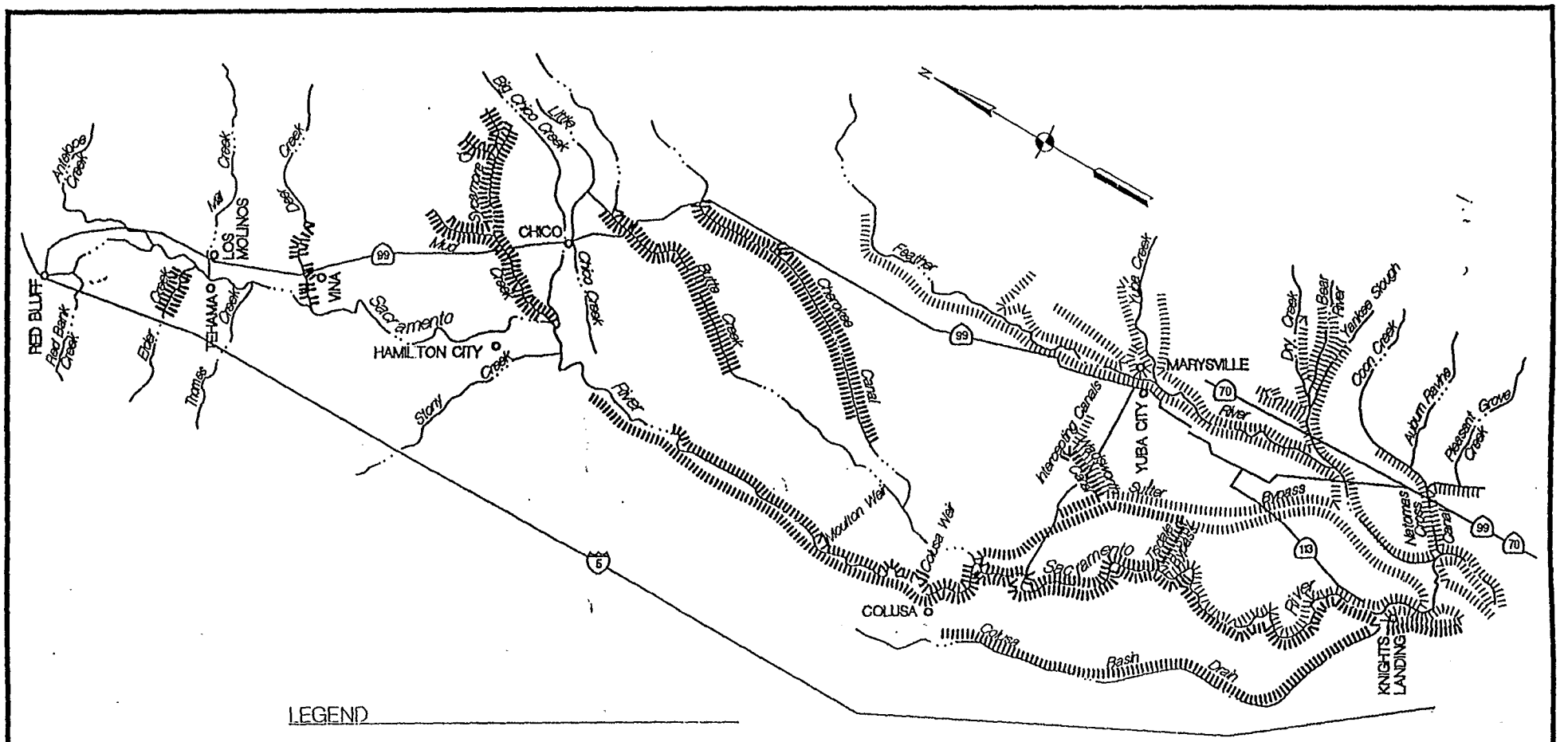

LEGEND

EXTENT OF LEVEE EVALUATION

LEVEES NOT EVALUATED (In this Study)

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
UPPER SACRAMENTO AREA

STUDY
AREA

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1994

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All work would be on top of the levee or on the landside. A description of the alternatives is given below. A cross section of each alternative is shown on Figure 3.

5.1 **No Action**. This alternative would maintain the project levees in their current condition. This alternative is likely to result in levee failure for flood events of lesser magnitude than specified for design conditions and cause significant economic damages, loss of endangered species, and possible loss of life.

5.2 **Construction of a Cutoff Wall**. A cutoff wall would require the excavation of a narrow trench down the middle of the levee embankment. The trench would be filled with a soil cement mixture to create a barrier to the movement of water through the levee. To function successfully, the cutoff wall must penetrate the foundation a predetermined distance.

5.3 **Construction of a Sloping Drain and Stabilizing Berm or Stabilizing Berm Only (Landside)**. This alternative would require clearing and grubbing the lower half of the landward levee slope and placing drain rock with a filter blanket across the lower slope where a sloping drain is required. The levee would be backfilled to its original slope. Installation of the drain rock serves to strengthen the levee by permitting the drainage of water, while retarding the loss of levee material. The combination of the berm with the drain rock would add stability to the levee. A 5- to 12-foot-high berm of varying width would then be constructed. The addition of the berm would also act to prevent levee sloughing. The use of a stabilizing berm alone would increase stability. This alternative would include the relocation of any irrigation drainage ditches adjacent to the landside levee toe.

5.4 **Levee Crown Restoration**. This alternative would restore the existing levee embankment in those levee reaches that do not have the minimum required design freeboard above the design water-surface elevation. Levee raising would primarily involve slightly widening the levee embankment on the crown. This alternative would require obtaining fill material from borrow areas.

5.5 **Levee Crown Restoration and Construction of a Stabilizing Berm**. This alternative would be a combination of the two alternatives described in paragraphs 5.3 and 5.4 (without a sloping drain).

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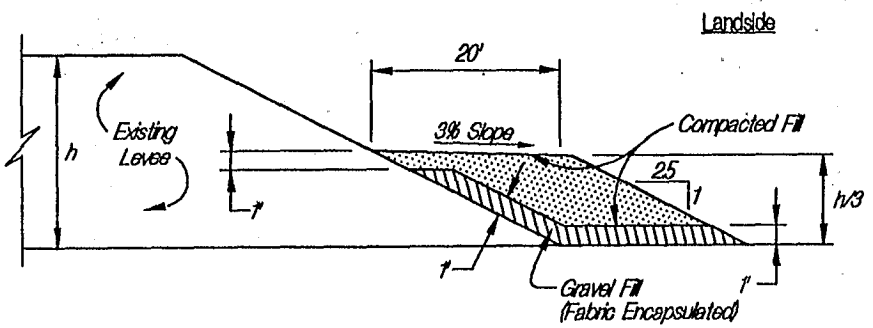
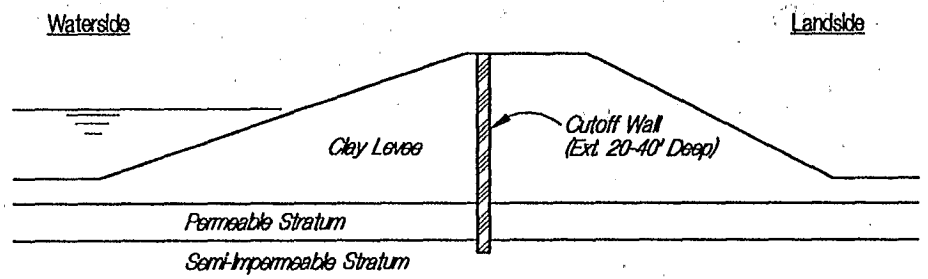
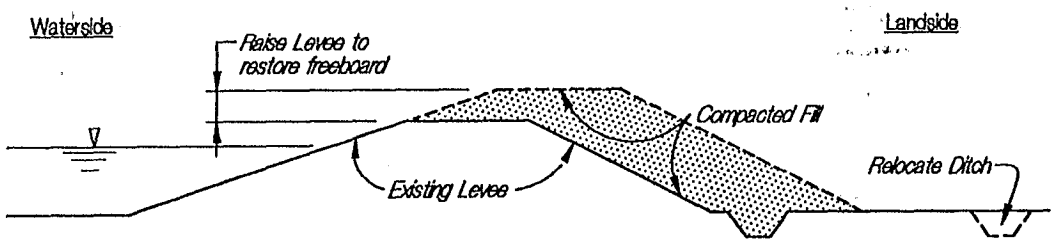


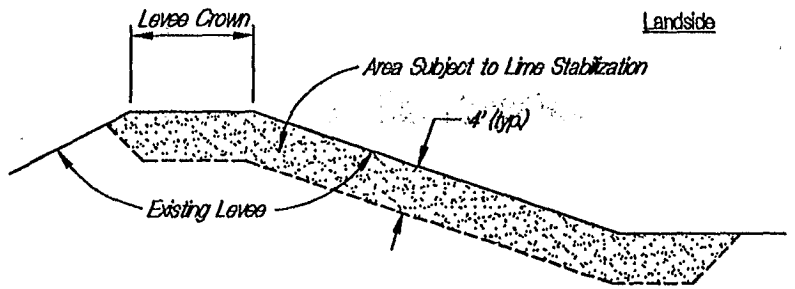
TYPICAL CROSS SECTION
LANDSIDE BERM WITH SLOPING DRAIN



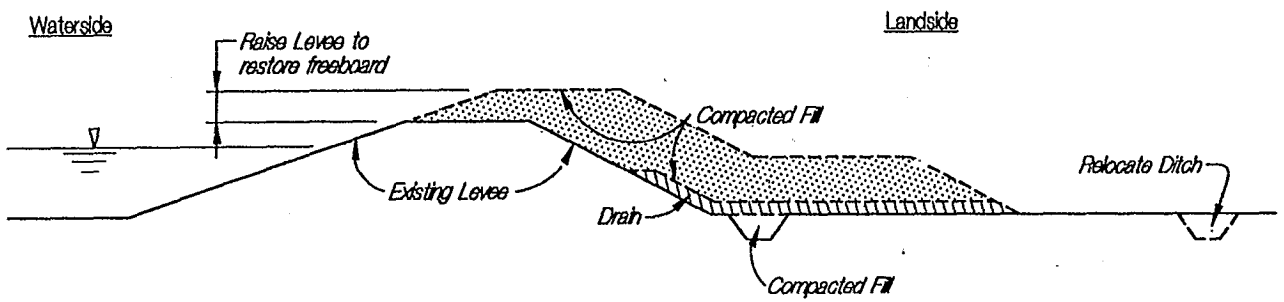
TYPICAL CROSS SECTION
CUTOFF WALL CONSTRUCTION



TYPICAL CROSS SECTION
LEVEE RAISING AND DITCH RELOCATION



TYPICAL CROSS SECTION
LIME STABILIZATION L/S SLOPE & CROWN



TYPICAL CROSS SECTION
LEVEE RAISING, LANDSIDE BERM, SLOPING DRAIN,
AND DITCH RELOCATION

SACRAMENTO RIVER FLOOD CONTROL
SYSTEM EVALUATION
UPPER SACRAMENTO AREA

LEVEE EMBANKMENT RECONSTRUCTION ALTERNATIVES

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
JANUARY 1995

Figure 3

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Figure 3

5.6 **Levee Crown Restoration, Construction of a Stabilizing Berm, and Mix with Lime Treatment**. This alternative would include a lime treatment with the alternative described in paragraph 5.5. Mix with lime treatment would involve removing a 4-foot depth of levee material from the crown and landside slope to about 10 feet beyond the levee toe, stockpiling the material, mixing it with lime (approximately 2 to 4 percent), and recompacting it to an established landside slope. The landside slope would vary from site to site from 2:1 to 4:1. Mix with lime treatment could also be accomplished by in-place mixing of the levee slope with lime (approximately 2 to 4 percent). The levee slopes and crown would be reconstructed during the process. Direct construction impacts would consist of generating lime dust, removing vegetation (clearing and grubbing) on the crown and landside slope to about 10 feet beyond the toe, and about the top 5 feet of the waterside slope. Specific measures would be required of the construction contractor to control lime dust. Lime treatment would reduce cracking, swelling, and slumping of the landside levee slope and crown.

5.7 **Reconstruction Plan**. Specifically, Phase V construction would consist of levee reconstruction at five sites--three along the Sacramento River from Knights Landing (river mile 90) to Colusa (river mile 143), and two along the Colusa Basin Drain just west of the Knights Landing. (See Figure 4 for site locations.) The design methods proposed at each site depend on the site soil conditions, structure of the existing levee, and the type and extent of repairs required. Specific design methods proposed for each site are described below.

Site A. Site A is located along 15,500 linear feet of the Colusa Basin Drain, from about 1.5 miles west of Knights Landing Ridge Cut west to Road 99A. Proposed work at Site A consists of cutting and reshaping the existing landside slope, building a landside stability berm (15 feet from the top of the levee crown, 2 to 8 feet high, and 20 feet wide), restoring the levee crown in two areas (2,100 linear feet and 1,200 linear feet long), and relocating a large irrigation ditch 50 feet from the existing levee toe. The first 8,000 linear feet of levee crown and landside levee slope eastward of Road 99A would undergo a lime treatment. The lime treatment consists of adding 2 to 4 percent by weight lime and mixing to a depth of 4 feet on the landside slope and crown with any organic matter being removed.

Construction could possibly be modified to further reduce adversely affecting fish and wildlife habitat by reshaping the landside levee slope and not relocating the ditch. Additional study and design modifications would be necessary in the Design Memorandum and Plans and Specifications.

Site B. Site B is located along 29,000 linear feet of the Colusa Basin Drain, running west from Road 99A. Proposed work at Site B consists of cutting and reshaping the landside slope,

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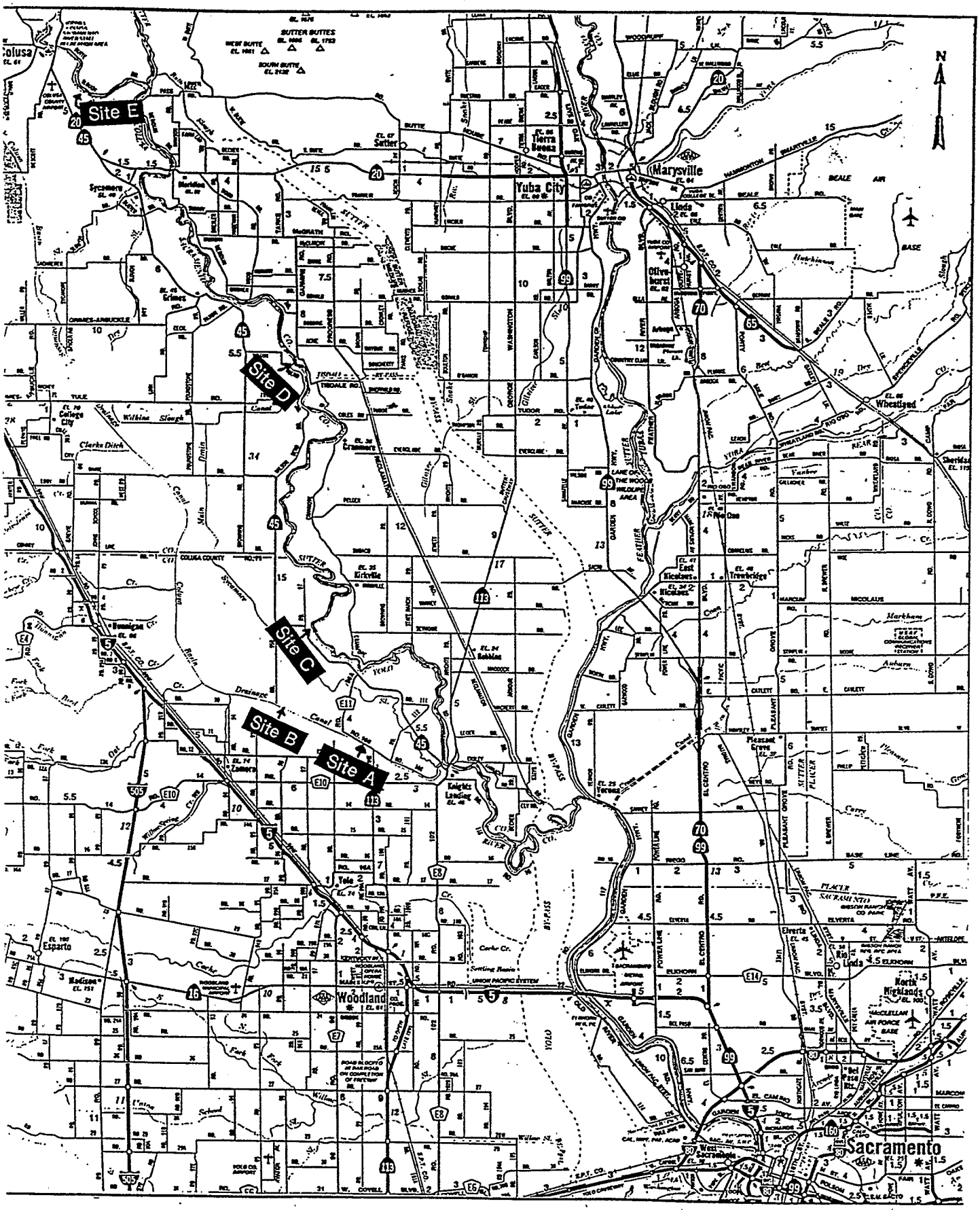
Site E
Site D
Site C
Site B
Site A
Colusa
Sutter
Yuba City
Marysville
Olivehurst
Wheatland
Woodland
Sacramento
Esparto
Knights Landing
Yolo
Zamora
Kirkville
Grimes
Sycamore
Meridian
College City
Cranmore
Nicolaus
Trowbridge
Pleasant Grove
Elverta
Rio Linda
North Highlands
West Sacramento
Arbuckle
Williams
Dunnigan
Hamilton City
Princeton
Robbins
Live Oak
Arboga
Linda
Beale AFB
McClellan AIR FORCE BASE
SUTTER BUTTES
SOUTH BUTTE
Sutter Bypass
Yolo Bypass
Sacramento River
Feather River
Yuba River
Sacramento Slough
Colusa County
Yolo County
Sutter County
Yuba County
Placer County
Sacramento County
Yolo Bypass Wildlife Area
Lake of the Woods Wildlife Area
Sacramento Metropolitan Airport
Sacramento Regional Transit District
Sacramento Municipal Utility District
Sacramento Regional Sanitation District
Sacramento Area Flood Control Agency
Sacramento Valley Irrigation Canal
Sacramento Valley Canal
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building 29,000 linear feet of landside stability berm, restoring the levee crown (3,200 linear feet), and relocating a large irrigation ditch 50 feet from the existing levee toe (same as Site A).

Construction could possibly be modified to further reduce adversely affecting fish and wildlife habitat by varying the landside berm slope as well as eliminating or reducing ditch relocation to preserve habitat as much as possible. Theseoptions would be extensively reviewed in the Design Memorandum and Plans and Specifications.

Site C. Site C is located on the right bank of the Sacramento River, river mile 101.80 to 102.05. At this site, proposed work consists of placing about 2 to 3 feet of embankment material on top of the existing levee centerline on the road west of the rice storage bins and filling existing depressions on the top of the levee along 1,500 linear feet of reach.

A 3-foot-high floodwall on the waterside of the levee could be constructed to avoid affecting the rice storage bins located at this site. Another option could be to change the centerline of the levee crown to an existing waterside road, add 2 to 3 feet of embankment material, and reshape the waterside levee face just above the water. However, these two options are no longer being considered because they are not cost effective.

Site D. Site D is located along 2,700 linear feet of the Sacramento River, between river miles 119.1 and 119.6 on the right bank. Proposed construction at Site D consists of the addition of a landside seepage/stability berm that is 20 feet wide at the top and located about one-third of the way up from the base of the existing levee toe. Gravel or rock would be placed in the base of the constructed berm to control seepage and prevent the movement of levee soil.

Three design options may also be considered with this alternative to minimize biological impacts at this site: (1) constructing a cutoff bentonite-cement slurry wall down the centerline of the levee, (2) tapering the berm width, and (3) burying the trunks of large trees with soil on the south end of the site. These options would be extensively reviewed in the Design Memorandum and Plans and Specifications.

Site E. Site E is located along approximately 16,700 linear feet of the right bank of the Sacramento River, between river miles 140.0 and 143.17. Proposed landside construction alternatives at this site are the same as those proposed for Site D. While the construction design does not include work in areas of ramps, it does include limited work close to existing farm and residential buildings. Any limited work would use one or more of the design options proposed for Site D to minimize biological impacts at this site.

A cutoff bentonite-cement slurry wall could be constructed in front of several existing farm and residential buildings to avoid affecting these structures and trees. The slurry wall could possibly be constructed along the entire reach; however, this option may not be cost effective. These design options would be extensively reviewed in the Design Memorandum and Plans and Specifications.

6.0 **Existing Environment**. This section discusses the existing environment. Section 6.1 describes the general setting of the project area and existing environmental resources that are not likely to be affected by all phases of the project. Section 6.2 describes resources that could be affected by the proposed project construction alternatives. Project effects are addressed in section 7.0.

6.1 **Environmental Setting**. The project area is located along the Sacramento River and tributaries in the Central Valley of California. The Sacramento River system is the largest watershed in California, draining 26,300 square miles of the Central Valley and the Coast, Cascade, and Sierra Nevada mountain ranges. A system of levees bounds much of the Sacramento River downstream from Chico Landing to the Delta. Flows are regulated by major dams and reservoirs, such as Shasta on the mainstem river and Whiskeytown, Oroville, New Bullards Bar, Folsom, Black Butte, and Berryessa on the tributaries. In addition, water is transferred from the Trinity River to the Sacramento River via Whiskeytown and Keswick Reservoirs. Two thousand square miles of fertile agricultural land and about 50 communities are located in the system's flood plain (FWS, 1994b). The Butte Basin and Colusa Basin are also located within the study area.

6.1.1 **Hydrology**. The Sacramento River is an alluvial, meandering river with an average annual natural runoff of about 18 million acre-feet. Variations in streamflow generally occur in response to seasonal precipitation. Peak flows are normally experienced during the winter months of December, January, and February. Little or no rainfall occurs in the Sacramento River basin during the summer and early fall months; these months have a history of low river flows. The major tributaries of the Sacramento River are the Feather River system including the Yuba and Bear Rivers, and the American River.

6.1.2 **Climate**. This area of California's Central Valley has a semiarid climate with a long, warm, dry summer season from May through October which is followed by a cool, rainy season from November through April. The average annual rainfall is approximately 18 inches. During the summer, daytime temperatures occasionally exceed 100 degrees Fahrenheit. The winter temperatures are mild and rarely drop below 20 degrees Fahrenheit. The majority of precipitation in the area is provided by air masses moving in from the Pacific Ocean during the winter months. These storms usually move through the area

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from the west or northwest. Clear skies predominate throughout most of the year, but storms and fog frequently occur during the winter months (Corps, 1992a).

6.1.3 **Topography**. The Sacramento Valley is the central portion of the Sacramento River basin and extends 150 miles from Red Bluff in the north to Suisun Bay in the south. The valley varies 10 to 40 miles in width and ranges in elevation from about 300 feet above sea level to about 5 feet below sea level. Near the center of the valley, the Sutter Buttes, an old volcanic formation, rise abruptly to more that 2,100 feet and cover approximately 80 square miles of northern Sutter County.

6.1.4 **Geology**. The Sacramento Valley is a great plain built up with sediments eroded from the surrounding mountains. Geologic formations underlying the Sacramento Valley include igneous, metamorphic, and sedimentary rock types, which range in age from pre-Cretaceous to Recent. The project area is situated on vast alluvial deposits that have slowly accumulated over the last 100 million years. The materials have been derived from the surrounding uplands, transported by major streams, and deposited in successive clay, silt, sand, and gravel layers on the river flood plains, in local sinks, or within the shallow sea that periodically covered the valley floor. The surface sediments associated with the Sacramento River are primarily of three kinds: Older Victor formation, recent flood deposits, and recent basin deposits.

6.1.5 **Soils**. Most soils in the study area are recent alluvium consisting of unconsolidated deposits of clay, silt, and sand which occur as flood plain deposits. This soil type tends to be very young because fresh sediments are deposited (particularly within the bypasses) with each floodflow. Soils of this type are highly suited for a wide range of agricultural uses because of their high organic content.

6.1.6 **Hazardous, Toxic, and Radiological Wastes**. Hazardous, toxic, and radiological waste (HTRW) sites located in the study area could require special design or construction considerations for the proposed levee reconstruction alternatives. The Corps field investigation of the reconstruction sites in the Upper Sacramento Area in May 1994 showed no evidence of HTRW. Contamination is most likely to be discovered near old storage tanks and drums deposited or stockpiled near levees. There are agricultural sheds located near the levee toe along Site E and commercial structures on Site C. Two old oil storage areas are located along Site E (Shell Oil and Union 76 areas). The Shell Oil storage area has been undergoing HTRW clean up, but these activities are not expected to affect the project. A slurry cutoff wall may be used adjacent to these sites. All borrow, borrow sites, and project lands will need to be free of HTRW before the lands can be used for project reconstruction. Some of the potential borrow sites have already been certified by the State as being

free of HTRW. The State is responsible for ensuring that all project lands are free of HTRW before levee reconstruction begins.

The Corps recently developed agency policy in response to CERCLA, which holds certain categories of individuals strictly liable for all clean up and response costs of any hazardous substances regulated under CERCLA. This policy states that between the Government and the local sponsor, it would generally be the local sponsor's responsibility to assure clean up and pay all response costs for any HTRW sites located on a Civil Works project. However, if HTRW material exists within the construction area, the Federal Government would determine as soon as possible the extent and nature of the contaminated material prior to construction. If already in construction, the Federal Government and local sponsor shall decide whether to continue construction, terminate construction or, if possible, redesign the project. In any event, should the Federal Government and local sponsor decide to proceed or continue with construction after considering any liability that may arise under CERCLA, the local sponsor shall be responsible for any studies, investigations, clean up and response costs. In addition, the local sponsor shall operate, maintain, repair, replace, and rehabilitate the project in a manner so that liability would not arise under CERCLA.

Lime materials would demonstrate hazardous waste characteristics at a pH of 12.5 that can harm human tissue, vegetation and aquatic life and may react dangerously with other wastes. The pH of water solution (25 C) with lime is 12.4. Pure lime is a skin irritant and inhalation of lime dust should also be avoided.

Lime treatment of levees would be carefully monitored by the contractor to keep lime/soil pH below 12.5. All construction workers would be required to wear masks or air filtering devices to avoid lime dust inhalation. In addition, goggles, gloves and full-body clothing should be worn to prevent skin contact with lime materials. Lime materials would be stockpiled on impervious material with a plastic cover to prevent wind dispersion, leaching and erosion. The lime/soil mixture when hydrated and compacting properly would result in a stabile mixture that resists erosion.

6.2 **Affected Environment**.

6.2.1 **Air Quality**. The project is within the Sacramento Valley Air Basin. The topographic boundaries of the basin, coupled with light winds and atmospheric stability, make the basin susceptible to the accumulation of air pollutants. The typical summer circulation system allows transport of pollutants for long distances north and south along the valley.

The major air pollution problems in the basin are high concentrations of oxidants and suspended particulate matter.

Both pollutants frequently exceed air quality standards. The largest source of oxidants is motor vehicles, and the major sources of suspended particulate are the agriculture and lumber industries. Agricultural burning is a widely practiced procedure for cropland waste disposal.

6.2.2 **Water Quality**. The overall water quality of the Sacramento River system is generally good, but the quality varies at specific sites due to the effects of variable streamflow and the quantity of local waste discharges and irrigation return flows. Higher sediment loads and extensive irrigated agriculture tend to degrade water quality. During the spring and fall, excess irrigation waters are discharged into drainage canals that flow to the river. In the winter, the rainfall-runoff flows over these same areas. In both instances, flows are highly turbid and introduce herbicides and pesticides into the drainage canals.

6.2.3 **Land Use**. Land use in the Upper Sacramento Area is dominated by agriculture. Most levees are bordered by orchards, row and grain crops, rice fields, and open pastures as well as scattered residential developments. Many irrigation diversions are made from the Sacramento River and its tributaries. Minor residential and commercial development exists in or near the communities of Knights Landing, Grimes, Sycamore, Meridian, Colusa, Princeton, Butte City, Glenn, Ordbend, Hamilton City, Vina, and Richardson Springs. Major urban centers in the Upper Sacramento Area include Colusa and Chico. The Colusa Weir, Butte Basin, and portions of both the Tisdale and Sutter Bypasses are in the study area. These bypasses are used to convey overflow from the Sacramento River; consequently, no residential or commercial development, other than agriculture, is allowed within the bypasses. A portion of the Sutter Bypass is also designated as a national wildlife refuge and is managed by FWS for wildlife values in coordination with its primary purpose of flood control.

6.2.4 **Fish**. The Sacramento River flows through the study area and provides important habitat for a variety of both anadromous and resident fish species. Anadromous and resident fish resources in the river are of high recreational and economic value. Anadromous fish such as striped bass, steelhead trout, American shad, sturgeon, and four races of chinook salmon use the Sacramento River for both spawning or rearing habitat. Of greatest importance is the chinook salmon. The Sacramento River supports the largest chinook salmon population in the state (FWS, 1990).

The distribution and abundance of the chinook salmon run is limited by the availability of suitable habitat during the respective spawning seasons. The most abundant race is the fall-run chinook which comprises about 80 percent of the Sacramento stock. The winter-run race of chinook salmon has suffered dramatic declines in abundance since 1969 and is now listed as endangered at the Federal and State level. Conditions

are suitable for salmon spawning above Butte City in the Sacramento River. A portion of this habitat is located in the Upper Sacramento project area.

Butte Creek originates at an elevation of approximately 6,500 feet in northeastern Butte County and flows south to southwest to the Sacramento River. The section of Butte Creek within the Phase V project boundary supports runs of steelhead and spring- and fall-run chinook salmon (FWS, 1990).

Deer Creek originates at an elevation of approximately 7,100 feet in northeastern Tehama County and flows 60 miles southwest before joining the Sacramento River. Deer Creek supports runs of steelhead and spring- and fall-run chinook salmon. Deer Creek contains some of the last wild stocks of spring-run chinook salmon in the Sacramento River system.

Cherokee Canal flows from the Western Canal to its confluence with Butte Creek in the Butte Sink. Spring- and fall-run chinook salmon use the canal as a migratory route (FWS, 1990).

Mud Creek originates at an elevation of approximately 3,000 feet in northcentral Butte County, just east of the town of Cohasset. Mud Creek flows southwest and joins Big Chico Creek just before flowing into the Sacramento River. Mud Creek is an intermittent stream and does not sustain perennial flows. During sustained flows, juvenile spring-run salmon may use Mud Creek as nursery habitat (FWS, 1990).

Sycamore Creek, an intermittent stream, originates at an elevation of approximately 600 feet in central Butte County and flows about 4 miles before joining Mud Creek. Fish populations are similar to Mud Creek.

Elder Creek originates at an elevation of approximately 6,500 feet in northwestern Tehama County and flows east approximately 45 miles to its confluence with the Sacramento River (Corps, 1959, 1963). Elder Creek is an intermittent stream and is usually dry during the late summer. However, both salmon and steelhead spawn in the stream during the fall and winter months. Small numbers of chinook salmon spawn in Elder Creek in years of above-normal runoff when flows are sufficient. Past records indicate that Elder Creek is dry from August until mid-November during most years. The salmon spawning runs enter Elder Creek following the first fall rains (Heeley, 1994).

Resident species in the Sacramento River include catfish, black bass, largemouth bass, black crappie, warmouth, Sacramento squawfish, bluegill, tule perch, sunfish, and Sacramento sucker. These resident species spend their entire life cycles in the Sacramento River. Most prefer shoreline areas along vegetated levees. Shaded riverine aquatic habitat is formed by a dense canopy of riparian vegetation that overhangs the water. Shaded riverine aquatic habitat provides partial to complete shade

during the day and essential spawning cover for sunfish and catfish in particular.

Portions of both the Sutter and Tisdale Bypasses are within the study area. During flood periods, the Sutter and Tisdale Bypasses contain the same fish species that are found in the Sacramento River. During most of the year, the bypasses are dry and cultivated and do not provide fish habitat. Canals waterside of the project levees provide year-round habitat for warmwater fish such as catfish and carp.

The Colusa Basin Drain and Knights Landing Ridge Cut are also located in the study area. The Colusa Basin Drain is about 36 miles long and extends from the Knights Landing outfall gates to southwest of Colusa. The Colusa Basin Drain is part of a complex system of agricultural water delivery and drainage channels located in the central Sacramento Valley. The drain, which acts primarily to drain agricultural water, runs roughly parallel and to the west of the Sacramento River; the drain also delivers water to local agricultural areas. Much of the surrounding area is cropped in rice (FWS, 1995). Flows in the Colusa Basin Drain fluctuate dramatically, ranging from 0 to about 1,000 cfs at various times of the year. Average annual discharge from the drain is about 251,710 acre-feet during the irrigation period (from March or April to October or November) and 71,964 acre-feet during the non-irrigation period (FWS, 1995). The Colusa Basin Drain receives stormwater runoff during the rainy winter months from about October to March. Flows from the drain are deposited back into the Sacramento River at Knights Landing, or into the Yolo Bypass via the Knights Landing Ridge Cut during high flows (FWS, 1995).

The Knights Landing Ridge Cut is about 6 miles long and extends from Knights Landing to the west bank of the Yolo Bypass. The Colusa Basin Drain and the Knights Landing Ridge Cut transfer drainage water from the west side of the Central Valley to the Yolo Bypass and provide year-round habitat for warm water fish such as catfish and carp. It is possible that resident or anadromous fish species in the Sacramento River may stray into the Colusa Basin Drain or Knights Landing Ridge Cut during periods of high flows.

6.2.5 <u>Vegetation</u>. There are four main habitat types in the project area: riparian forest, riparian shrub/scrub, emergent marsh, and agriculture/grassland.

Riparian forest grows along rivers and stream courses in the study area. Riparian forest varies in width from a few yards where the levee is the riverbank to wide areas where the levee is set back from the river. Riparian forest may consist of a layered or single-story community. The overstory is generally composed of species such as sycamore, cottonwood, valley oak, and large willows. Some trees have grapevines or mistletoe growing on them (FWS, 1990). The midstory is composed of box elder, black walnut, white alder, elderberry, Oregon ash,

C-103964

C-103964

black locust, and younger species of the overstory. The understory is dominated by raspberry, blackberry, mugwort, western ragweed, pigweed, clover, cocklebur, several thistles, poison oak, wild grape, wild rose, grasses, and forbs. Nonnative woody species commonly found include eucalyptus, acacia, giant reed, and honey locust. Berms along the levee contain several varieties of grasses, forbs, weeds, and woody species such as cottonwood or willow.

Riparian shrub/scrub is dominated by a mix of shrubs and young trees with an understory of grasses and forbs. Typical species found in shrub/scrub areas are Himalaya berry, wild blackberry, poison oak, California rose, and wild grape. In addition, various species of willow and young seedlings of box elder, cottonwood, and Oregon ash are found in this habitat. Riparian shrub/scrub is generally found in the same areas as riparian forest.

Riparian vegetation can be found along the waterside of the project levees of the Sacramento River, Colusa Basin Drain, Knights Landing Ridge Cut, Sutter Bypass, Butte Creek, Cherokee Canal, Mud Creek, Elder Creek, Sycamore Creek, and Deer Creek. Riparian forest is generally sparse along the landside of project levees. Currently, only 5 to 15 percent of the original riparian habitat remains in the Central Valley and generally occurs as fragmented patches in scrub-shrub, forest, emergent marsh, and grassland areas.

Freshwater emergent marsh habitat is composed of dense stands of nonwoody aquatic vegetative species. Most common are cattails, giant bulrush, umbrella sedge, water smartweed, iceplant, California hibiscus, western verbena, and marsh pennywort. Freshwater emergent marsh can be found along the Sacramento River and associated tributaries, irrigation drainage canals, and levee toe drains.

The grassland plant community is dominated by a number of annual forbs and grasses such as wild oats, common foxtail, cheeseweed, and Italian rye grass. This community is typically found along the levee slopes.

The agricultural plant community consists of thousands of acres of economically important crops including orchards and field crops such as almonds, pears, peaches, rice, tomatoes, sugar beets, and corn. Agricultural lands within the project area consist predominantly of rice fields and orchards. Rice fields are found landside of project levees primarily along the Colusa Basin Drain, and orchards are found landside of project levees along the Sacramento River. Orchards in the project area consist mostly of walnut and fruit trees. Most of this agricultural land was converted from native woodland and grassland communities. Agricultural communities are generally found landward of the levee.

6.2.6 **Wildlife**. Wildlife resources are generally associated with the type of vegetative habitat available for food, cover, and nesting. Habitat types are discussed in section 6.2.5; wildlife species associated with these habitats are described below.

Riparian forest supports dense and diverse wildlife communities and provides nesting habitat for large birds such as hawks, owls, crows, and ravens. Riparian forest also provides habitat for cavity-nesting species such as woodpeckers, wood duck, bats, western gray squirrel, raccoons, and ringtail. The understory supports such species as Anna's hummingbird, scrub jay, black-headed grosbeak, house finch, cottontail and jackrabbit, mule deer, mink, weasel, skunk, muskrat, Virginia opossum, and red and gray fox. Amphibians and reptiles which may be found along the river include the western pond turtle, western rattlesnake, alligator lizard, gopher snake, western fence lizard, garter snake, and Pacific tree frog. Riparian shrub/scrub support many of the species found in riparian forest but with smaller populations.

Freshwater emergent marsh habitat provides cover for species such as herons, egrets, bitterns, red-winged blackbird, marsh wren, and muskrat. Marshes provide critical feeding habitat and cover to certain waterfowl, such as surface-feeding and bay ducks, and also to wading birds. Approximately 19,000 acres of the Butte Sink in Butte Basin are natural emergent and open-water wetlands which provide outstanding habitat for waterfowl and other water-associated wildlife (FWS, 1990). Freshwater emergent marsh habitat is also found in the Colusa Basin. Marsh areas provide breeding habitat for reptiles and amphibians such as the Pacific tree frog.

Grassland habitats support species that feed on seeds, vegetation, and ground-dwelling insects. These species include the California ring-necked pheasant, ground squirrel, Botta's pocket gopher, California vole, California quail, mourning dove, European starling, and Brewer's blackbird. Grassland areas also provide important foraging habitat for raptor species.

Wildlife species found in agricultural areas are similar to those found in grassland areas. Waterfowl species frequently use flooded agricultural fields, especially during migration. The Sacramento basin is important as one of the prime waterfowl wintering areas in the Pacific Flyway, and the Sacramento Valley's wintering waterfowl population often exceeds 3 million birds. Agricultural fields are more frequently disturbed and lack sufficient cover to support species as diverse as those found in grassland areas. Waterfowl in the valley include the mallard, pintail, widgeon, tundra swan, Canada goose, white goose (snow goose or Ross's goose), and other less common species.

6.2.7 **Cultural Resources**. The upper Sacramento Valley is a region that has been the subject of 50 years of

C-103966

C-103966

archeological research. Previous investigations located several archeological sites along the Sacramento River including one that may date back to the beginning of human occupation in the northern Sacramento Valley (Johnson, 1974). Archaeologists have postulated three occupation phases in the area of the valley floor and nearby foothills, with the earliest phase dating to about 2000 B.C. A more detailed discussion of these cultural complexes and regional prehistory can be found in Moratto (1984).

Three Native American groups, the Patwin, Konkow Maidu, and River Nomlaki, formerly occupied the study area. The Patwin lived in large autonomous villages on natural rises along the Sacramento River. The Patwin gathered their food from surrounding grasslands. They ate fish, game, acorns, and grass seeds (Johnson, 1974, 1978, 1983; Bouey, 1989). The Konkow Maidu inhabited the area along the Sacramento and Feather Rivers above Sutter Buttes. The Konkow followed an annual gathering cycle that took them into the mountains to hunt in summer and back down to the valley floor in spring. They preferred three varieties of acorns, fish and eels, and game animals (Ridell, 1978). The territory of the River Nomlaki's followed the Sacramento River north of Konkow territory to Cottonwood Creek above Red Bluff. The River Nomlaki lived by hunting and gathering. They ate eight different varieties of acorns, grass seeds, tubers, deer, elk, and small game animals (Goldschmidt, 1978).

Although the Spanish occupied portions of California as early as 1769, they did not explore the study area until much later. In the 1830's, fur trappers such as Jedediah Smith, Ewing Young, and John Work trapped along the Sacramento River. By the time that John Sutter arrived in 1839, the valley was fairly well known. Settlement of the upper valley did not begin in earnest until after the discovery of gold in 1848 (Bean, 1968; Beck and Williams, 1972). A major hinderance to settlement was flooding. The development of a systematic method of dealing with floodwaters and irrigation needs in the Sacramento Valley began in the 1870's. This systematic method culminated in 1917 with the passage of the Flood Control Act and provided Federal funds to aid construction of the Sacramento Valley Flood Control Project (Kelley, 1989).

It will be necessary to identify and evaluate historic properties in the project area of potential effect, and, if applicable, mitigate the effects of the project on any identified properties. Section 106 of the National Historic Preservation Act, as amended, and implementing regulations contained in 36 CFR 800 require consultation with the State Historic Preservation Office (SHPO) and, if necessary, the Advisory Council on Historic Preservation.

Cultural resource inventories and other investigations have been completed for most of the areas of potential effect identified for Sites A through E. These studies include a

C—103967

C-103967

reconnaissance archeological survey of 151 locations on the Sacramento River drainage system from Elder Creek to Rio Vista by Jerald J. Johnson in 1974, a cultural resources inventory and evaluation of the Sacramento River Bank Protection Project, units 42 and 43, by Roger H. Werner in 1988, and a cultural resources inventory for the Colusa Basin/Knights Landing Ridge Cut Levees Project in Colusa and Yolo Counties by Lisa A. Shapiro in 1992. All three reports are on file at the U.S. Army Corps of Engineers District Office in Sacramento, California.

6.2.8 **Rare, Threatened, and Endangered Species**. In August 1994, the FWS reported that 23 species which are Federally listed or proposed endangered and threatened may occur in the project area or may be affected by the proposed project (FWS, 1994) (Appendix A). In addition, the FWS listed 54 candidate species that may occur along the Sacramento River and tributaries included in the Phase V project area. The PAR from the FWS also reported six State-listed species that may be found in the project area (FWS, 1995). Federal and State-listed and proposed endangered, threatened, and candidate species that may occur in the area or may be affected by the proposed project are provided in Table 1. As this investigation progresses, a detailed study will be made of the potential impacts to these species.

Table 1
Listed and Proposed Endangered, Threatened, and Candidate Species that May Occur in the Study Area

Species	Status Federal	Status State
winter-run chinook salmon	E	E
delta smelt	T	T
giant garter snake	T	T
bald eagle	E	E
Aleutian Canada goose	T	N
valley elderberry longhorn beetle	T	N
palmate-bracted bird's-beak	E	N
Contra Costa wallflower	E	E
Butte County (Shippee) meadowfoam	E	E
Antioch Dunes evening-primrose	E	E
Sacramento splittail	PT	N
California red-legged frog	PE	N
Stebbins' morning-glory	PE	E
Pine hill ceanothus	PE	R
Hoover's spurge	PT	N
Pine Hill flannelbush	PE	N
El Dorado bedstraw	PE	R
Colusa grass	PT	E
pilose Orcutt grass	PE	E
slender Orcutt grass	PT	E
Hartweg's golden sunburst	PE	E
Layne's butterweed	PT	R
Greene's tuctoria	PE	R
green sturgeon	C	N
longfin smelt	C	N
western spadefoot toad	C	N
foothill yellow-legged frog	C	N
California tiger salamander	C	N
northwestern pond turtle	C	N
southwestern pond turtle	C	N
tricolored blackbird	C	N
loggerhead shrike	C	N
Pacific western big-eared bat	C	N
greater western mastiff-bat	C	N
San Francisco dusky-footed woodrat	C	N
San Joaquin Valley woodrat	C	N
spotted bat	C	N
Marysville Heerman's kangaroo rat	C	N
Sacramento Valley tiger beetle	C	N
Suisun Marsh aster	C	N
Ferris's milk-vetch	C	N
alkali milk-vetch	C	N
heartscale	C	N
brittlescale	C	N
big tarplant	C	N
Fremont's rosinweed	C	N
Butte County morning-glory	C	N
Red Hills soaproot	C	N
Mosquin's clarkia	C	N
Enterprise clarkia	C	N
hispid bird's-beak	C	N
soft bird's-beak	C	R
silky cryptantha	C	N

C-103969

C-103969

Table 1 - Continued
Listed and Proposed Endangered, Threatened, and Candidate Species that May Occur in the Study Area

Species	Status Federal	Status State
recurved larkspur	C	N
diamond-petaled poppy	C	N
Butte fritillary	C	N
fragrant fritillary	C	N
adobe lily	C	N
Brewer's dwarf-flax	C	N
Northern California black walnut	C	N
Ahart's rush	C	N
Contra Costa goldfields	C	N
delta tule-pea	C	N
legenere	C	N
Mason's lilaeopsis	C	R
veiny monardella	C	N
Ahart's whitlow-wort	C	N
closed-lip beardtongue	C	N
Gairdner's yampah	C	N
California beaked-rush	C	N
valley sagittaria	C	N
Tracy's sanicle	C	N
Butte County sidalcea	C	N
Butte County (western) catchfly	C	N
showy Indian clover	C	N
caper-fruited tropidocarpum	C	N
El Dorado mule-ears	C	N
bank swallow	N	T
Swainson's hawk	N	T
willow flycatcher	N	E
yellow-billed cuckoo	N	E

C--Candidate E--Endangered P--Proposed T--Threatened N--None R--Rare

7.0 Evaluation of Impacts.

7.1 Air Quality.

Without Project. Air pollution has been identified by the environmental community as a significant effect of continuing development in the Central Valley. Air quality throughout the Sacramento Valley Air Basin is affected by a combination of air contaminants, meteorological conditions, and topographical configuration of the Valley (Corps, 1992b). As a result, air quality could continue to decline in the project area. Pollutants are most highly concentrated between May and October, corresponding to the time of year that the Pacific high pressure system dominates northern California. This high pressure creates an inversion layer that suppresses the upward motion of air, trapping pollutants near the ground surface and up against the flanking mountain ranges of the basin. During this time of year, the wind direction is from the south, bringing higher concentrations of pollutants to Sacramento (Corps, 1992b).

The Sacramento Valley Air Basin is designated by the U.S. Environmental Protection Agency as a non-attainment area for ozone and suspended particulate matter (EPA, 1993). The Phase V project area is located within six counties of the Sacramento Valley Air Basin: Tehama, Butte, Glenn, Sutter, Colusa, and Yolo Counties. All six counties have adopted regulations pertaining to activities which affect air quality. Their regulations regulate open burning, agricultural burning, industrial and commercial wastes, and emissions from residential areas (Corps, 1992b).

With Project. Stabilization of the levee system would only restore the congressionally authorized design conditions and, as a result, is not expected to affect existing growth trends in the flood plain and adjacent areas. Therefore, a long-term increase in air pollution due to the project is not expected.

Minor, short-term, construction-related increases in noise levels, traffic, and dust would be expected. Construction contractors are required to maintain all construction areas free from dust or other air emissions that would cause the local standards for air pollution to be exceeded or would cause a hazard or nuisance to others.

7.2 Water Quality.

Without Project. The water quality of the Sacramento River, Knights Landing Ridge Cut, and Colusa Basin Drain are seasonally poor as a result of high sediment loads and extensive agriculture irrigation discharges. Water quality could be further degraded as an immediate result of levee failure and as a result of extensive levee reconstruction work. If no reconstruction work is done, possible future levee breaks would cause a short-term degradation in water quality due to the

influx of pollutants from flooded areas. Furthermore, a large-scale failure of the levee system would likely necessitate extensive levee repairs. Depending on the location of the break, construction could cause degradation of water resources in the Sacramento River and Colusa Basin Drain from contamination of petroleum products used for construction equipment and increased turbidity from waterside repair work.

With Project. Any proposed construction confined to the levee crown, landside levee slope, or near the landside levee toe would have little or no impact on water quality since no work would be done in the river. Potential work filling old irrigation drainage ditches and constructing new irrigation drainage ditches may temporarily increase turbidity in the drainage water that is pumped into the Sacramento River, Colusa Basin Drain, and Knight's Landing Ridge Cut and would require the preparation of an evaluation pursuant to 404(b)(1) of the 1977 Clean Water Act, as amended. In addition, construction activities near the Sacramento River and Colusa Basin Drain would increase the risk of spilling petroleum products into sensitive aquatic environments. The Corps would require the contractor to take the appropriate measures to avoid contaminating water resources. The source of water for potential construction of a slurry cutoff wall at Sites D and E could be municipal water from the city of Colusa, local irrigation canals, or the Sacramento River.

7.3 **Land Use**.

Without Project. Under this alternative, the Federal government would not participate in levee reconstruction measures. Agriculture, the predominant land use in the Sacramento River basin and along the project reaches, is expected to remain unchanged. Although economic losses could be high, long term changes in agricultural land use would not be anticipated as a direct effect of flooding. If no reconstruction work is done, possible future levee breaks could significantly damage residential, commercial, agricultural, and industrial developments in the project area.

With Project. The proposed reconstruction work would ensure that the existing levee system meets the congressionally approved design conditions. The work would not enhance the original design levels. Therefore, no land use changes are expected. Construction would generate noise, dust, and potential traffic disruptions which may adversely affect adjacent land uses. These impacts are short term and not considered significant.

Most of the identified borrow site areas consist of stockpiled dredge material from the Sacramento River. Acreage for the borrow sites is estimated to be 60 acres at Tisdale Weir, 100 acres at Colusa Weir, 50 acres at Fremont Weir, and 40 acres at Cache Creek Settling Basin. The Corps is considering using only two of the identified borrow sites for the project.

Some of the potential borrow sites are currently being used or may also be used for other Corps projects. Nine acres would be used as separate staging areas scattered throughout Sites A-E. Land used for borrow, staging, and mitigation areas would be surveyed by a qualified biologist prior to construction for sensitive vegetation and wildlife, a qualified archeologist for archaeological resources, and a qualified environmental inspector for HTRW contamination.

Table 2 summarizes the permanent, new, and temporary easements required for each site of Phase V construction. The majority of these areas are agricultural land with a limited amount of residential acreage. The commitment of the limited area required for permanent and temporary easements is less than significant from a land use perspective.

Table 2
Existing and New Easements for Each Construction Site
(feet)

Construction Site	Permanent Existing	Permanent New (landside)	Temporary New (landside)
Site A	80	76	20
Site B	80	76	20
Site C	80	0	0
Site D	80	40	20
Site E	80	40	20

7.4 **Fish**.

Without project. The fish of the Sacramento River and tributaries are not expected to change significantly as a result of no action. Some fish may be lost temporarily during a flood. Fish may spill into the flood plain and be lost when the floodwaters recede or are pumped out. Extensive levee reconstruction work that would be required subsequent to large-scale levee failure could adversely affect aquatic resources through increased turbidity, possible contamination of petroleum products from construction machinery, and disruption of habitat waterside of the levee. Aquatic resources in the Sacramento River and tributaries could continue to decline as a result of increased water diversions for agriculture, municipal, and industrial purposes.

C—103973

C-103973

With Project. No waterside repairs on the Sacramento River or Colusa Basin Drain are proposed; therefore, no impacts to fish resources are anticipated. Relocation of Sites A and B irrigation ditches could adversely affect various aquatic resources that stray into the ditches. The irrigation drainage ditches may provide limited habitat for stray warmwater species such as carp and catfish. However, the irrigation drainage ditches contain relatively shallow, warm, slow-moving water which is heavily contaminated with salts, fertilizers, herbicides, and pesticides. In addition, the irrigation drainage ditches carry water only during the irrigation periods and are dry when no irrigation takes place. Relocation activities may only temporarily reduce cover and disturb the existing aquatic ecosystem. Therefore, no adverse impacts are anticipated to fish resources.

7.5 **Vegetation and Wildlife**.

Without Project. Under the no action alternative, vegetation and wildlife species occurring along the project levees are not expected to change substantially. Project levees are periodically cleared of vegetation by either chemical or mechanical means (including burning). This levee maintenance is conducted to prevent the growth of dense vegetation and to allow inspection of the condition of the levee. In addition, maintenance often involves repairing levee embankments due to cracks, subsidence, burrowing animals, sloughing, and wave erosion. Maintenance practices are not expected to change.

If the levees are not repaired, possible future levee breaks could cause short-term impacts to vegetation and loss of wildlife. Contact with swiftly flowing floodwaters and prolonged inundation would adversely affect some plant and wildlife species, resulting in damage and mortality. Furthermore, a levee break would likely necessitate extensive levee repairs, depending on the proximity of the levee break, and subsequent reconstruction near sensitive environments such as riparian woodland, freshwater emergent marsh/wetlands, shaded riverine aquatic vegetation, and agricultural and grassland habitats.

With Project. The impacts of levee improvement alternatives on vegetation and wildlife would vary depending on the site. The primary direct environmental impact of the proposed reconstruction work is the removal of vegetation which in turn adversely affects wildlife species dependent on vegetative cover. Every effort would be made by the Corps to avoid or minimize adversely affecting vegetative and wildlife species while ensuring the integrity of the Upper Sacramento Area flood control system.

The loss of riparian vegetation along the project waterways would adversely affect many wildlife species. Riparian woodland supports a large and diverse array of wildlife species along the Sacramento River and, to a lesser extent, along the Colusa Basin

Drain. The high diversity of tree growth, cover conditions, and layers and close proximity to water provide a wide variety of easily accessible habitats and niches. Any loss of plant diversity would adversely affect those wildlife species inhabiting the area.

Any loss of riparian habitat would have a significant adverse impact on songbirds and small mammals that use these areas to meet all or part of their life requisites. Cover, nesting habitat, and food sources for songbirds would be lost, and cover, food, and a portion of the migration corridor for small mammals would be eliminated. In addition, any reptiles and amphibians which depend on this interface of terrestrial and aquatic habitats to meet their life needs would be adversely affected.

Construction activities and any disturbance or loss of riparian vegetation would likely adversely affect nesting raptors, including the Swainson's hawk. Loss or disturbance of nesting habitat could severely affect populations of these species.

Elimination of freshwater emergent wetlands would reduce the amount of available habitat for wading birds such herons and egrets, waterfowl such as mallard ducks and pied-billed grebe, and various species of amphibians and reptiles. However, impacts to emergent marsh species could be minimized if replacement habitat was created prior to elimination of existing habitat.

The impact on grassland and forbs on the levee slopes would be minimal and temporary. Disturbance or loss of this habitat would adversely affect some raptors, small mammals, and other ground-dwelling species. This impact would be temporary, however, because grasses and forbs would reestablish within a few years and thus regain habitat values similar to the pre-construction condition.

Small parcels of rice field habitat could be lost due to construction of the project. This loss could adversely affect wading birds, sandhill cranes, and wintering waterfowl, including ducks and geese, that use these areas for foraging during fall and winter. In areas where orchards occur adjacent to construction sites, the loss of fruit and nut trees could adversely affect perching birds that utilize the trees for resting and foraging. Construction activities during raptor nesting periods could lead to the failure of nesting success (FWS, 1995). However, rice fields and orchards are fairly abundant in the project area, and loss of small strips of agricultural habitat should not severely affect avian nesting and foraging species. In addition, use of agricultural lands for rice production in the Sacramento Valley has varied from season to season due to rotational farming practices. Because these agricultural parcels are intensively and artificially managed, construction of the project would have no significant

impacts on agricultural habitat. Farmers would be financially compensated for loss of agricultural areas. The wildlife value for agricultural parcels removed by construction activities may actually increase because they would no longer be farmed and natural vegetation could become established. The severity of potential effects would be further examined in a habitat evaluation procedure (HEP) report by FWS and in an environmental assessment/biological data report by the Corps.

Borrow material would be required to raise and reinforce the levees. The impacts on vegetation and wildlife at the borrow sites are anticipated to be minimal since existing habitat at the borrow sites is largely disturbed and therefore of low habitat value. Most of the identified borrow site areas consist of stockpiles material. More detailed surveys of the borrow areas should be conducted during the HEP analysis in the later stages of the planning process because cover type determinations at these sites for this analysis were based on rough interpretations of aerial photographs (FWS, 1995).

Preliminary estimates of direct impacts were made by FWS from aerial photos of the project area. Habitat types in the project area were delineated on 1:2,800 (1 inch = 400 feet) scale blueline copies of aerial photographs. Estimates of direct construction impacts were made by delineating the boundaries of the permanent and temporary construction easements onto habitat maps, and calculating the affected acreage (Table 3). FWS preliminary estimates for total impacts indicate that 76.42 acres of wildlife habitat would be affected by project construction. This estimate includes 7.32 acres of riparian woodland habitat, 5.60 acres of emergent marsh habitat, 54.00 acres of rice field habitat, and 9.50 acres of orchard tree habitat. In addition, there are about 11 individual trees in the project area that could be removed although every effort would be made to avoid or minimize tree removal. Three elderberry bushes would have to be removed and replanted in the proposed mitigation areas. One elderberry bush is located at Site D, and two are located at Site E. The Corps has considered FWS's estimates and redesigned the construction alternatives to avoid affecting as much habitat as possible while ensuring the integrity of the levees.

The following paragraphs describe FWS's preliminary analysis of the impacts to vegetation and wildlife at each construction site, as well as ways these effects could be avoided or minimized (FWS, 1995). No secondary environmental impacts from development of agricultural or riparian areas would result from the project because the reconstruction would only restore the congressionally authorized design conditions.

Site A. Adverse impacts to vegetation and wildlife associated with proposed construction at Site A would not be significant. Landside construction would affect 2.9 acres of freshwater emergent marsh habitat and 27.0 acres of rice fields. Since drainage ditches would be replaced prior to filling old

C-103976

C-103976

Table 3
FWS's Estimates of Maximum Impacts, Mitigation, and Costs for Each Construction Site

Site Habitat Type	Construction Impacts	Estimated Compensation Ratio	Mitigation Needs	Mitigation Costs
Site A				
freshwater emergent marsh	2.90 acres	1.5:1	4.35 acres	$21,750
rice field	27.00 acres	1.5:1	40.50 acres	Undetermined
Site B				
freshwater emergent marsh	2.70 acres	1.5:1	4.05 acres	$20,250
rice field	27.00 acres	1.5:1	40.50 acres	Undetermined
Site C				
no habitat affected*	---	---	---	---
Site D				
riparian woodland	0.75 acre	3:1	2.25 acres	$56,000
Site E				
riparian woodland	6.57 acres	3:1	19.71 acres	$492,750
orchard	9.50 acres	1.5:1	14.25 acres	Undetermined
individual trees	11 trees	5:1	55 trees	Undetermined

*Assumes no waterside work.

ditches, net impacts to emergent marsh habitat would be minimal. FWS reports that rice field habitat provides important forage for wintering waterfowl species. However,considering the large amount of rice field habitat in the Site A project area (11,445 acres in Yolo County), the loss of 27.0 acres at Site A should not severely affect waterfowl populations (Yolo County Agriculture Commissioners Office, 1995). A loss of 27 acres out of 11,445 acres of rice field habitat is only about 0.2 percent of the total rice field acreage in Yolo County. Furthermore, rice fields in the area are rotated with other crops so yearly and seasonal rice plantings vary. As a result, wildlife impacts due to removal of small strips of agricultural land should be minor. Compensation for loss of agricultural lands will be further addressed in the HEP and Environmental Assessment.

Site B. Project construction at this site would result in the initial removal of 2.7 acres of freshwater emergent marsh and 27 acres of rice fields. All work would be conducted landside of project levees; therefore, no aquatic impacts are expected in the Colusa Basin Drain. Since drainage ditches would be replaced prior to filling old ditches, net impacts to emergent marsh habitat would be minimal. FWS reports that rice field habitat provides important forage for wintering waterfowl species. However, considering the amount of rice field habitat in the Site B project area (11,445 acres in Yolo County), the loss of an additional 27 acres should not severely affect waterfowl populations (Yolo County Agriculture Commissioner Office, 1995). A loss of an additional 27 acres out of 11,445 acres of rice field habitat is about 0.2 percent of the rice field acreage in Yolo County. Furthermore, rice fields in the area are rotated with other crops so yearly and seasonal rice plantings vary. As a result, wildlife impacts due to removal of small strips of agricultural land should be minor. Compensation for loss of agricultural lands will be further addressed in the HEP and Environmental Assessment.

Site C. Adverse impacts at Site C from restoration of the levee crown are expected to be minimal since existing vegetative and wildlife habitat quality at the site is low. If construction proceeds as described, no mitigation should be necessary. Any impacts to annual grassland habitat would be compensated by reseeding affected areas. This reseeding is part of the required reconstruction plan.

Site D. Impacts to wildlife habitat at Site D would consist of the elimination of about 0.75 acre of riparian woodland through berm construction on the landside of the levee. Annual grassland would also be removed by construction activities. Most of the woodland vegetation that would be removed consists of single valley oak trees and elderberry bushes. Selecting the cutoff wall alternative or deleting the south 100 feet of work would likely reduce any impacts to an insignificant level.

One proposed option to preserve large trees landside of the levee would be to cover a portion of the tree trunks with soil instead of removing the entire tree. However, soil placed on the surface around an existing tree can create problems involving soil moisture and gaseous exchange in the root zone (Haller, 1957). If filling must be incorporated, certain steps can be taken to ensure higher probability of success. However, the extent of harm depends on the kind of tree, age of tree, type and amount of fill (Haller, 1957), time of year (Whitcomb, 1991), and soil aeration and drainage (Harris, 1983). Some trees are quickly killed by small quantities of fill while others can survive several feet of fill. The U.S. Department of Agriculture maintains that fills of 6 inches or less with fair to good drainage will not harm most species of trees (Harris, 1983). However, Whitcomb (1991) alleges that fills of 3 inches or less can be done safely if employed gradually and under the

most favorable of conditions. If more than 3 to 6 inches of fill are required around the roots of a tree, Harris and Whitcomb agree that either the fill should be placed gradually, over a year or more, or the tree should be removed.

Site E. Habitat losses at this site include the elimination of 6.51 acres of riparian woodland, 9.50 acres of orchard, and 11 individual trees. All impacts to vegetation would occur landside of the existing levee. Selection of the cutoff wall alternative would likely reduce the impacts on riparian woodland, orchard, and individual trees. FWS reports that the loss of fruit and nut trees as a result of construction activities could adversely affect perching birds. However, considering the amount of orchard habitat in the Site E project area, a loss of 9.50 acres should not severely affect populations of perching birds (Colusa County Agriculture Commissioners Office, 1995). A loss of 9.50 acres out of 4,889 acres of orchard tree habitat is only about 0.2 percent of total orchard acreage in Colusa County. Compensation for loss of agricultural lands will be further addressed in the HEP and Environmental Assessment.

7.6 **Cultural Resources**.

Without Project. Based on earlier surveys, previous levee construction and agricultural practices have disturbed many sites in the study area. Cultural resources might be damaged both as an immediate result of levee failure and extensive levee reconstruction work that could be required after a large-scale failure of the levee system.

With Project. Further levee reconstruction could disturb known and unknown cultural resources and have an adverse effect on those resources. Cultural resources considerations and required actions for Sites A through E are as follows:

All Sites. All levees and associated structures older than 50 years will require evaluation for eligibility for nomination to the National Register of Historic Places.

Site A. Construction of the landside stability berm, restoration of the levee crown, and mix-in-place lime will affect only the levee. A cultural resource inventory of the entire project area (Shapiro, 1992) identified the Colusa Basin drainage canal and its associated features (levees, side irrigation ditches, pumphouses, culverts, concrete remnants, and iron orchard valves) as provisional site number AC-S-5 (CA-Yol-Pending). The canal was constructed between 1919 and 1920 and must be evaluated for National Register eligibility.

Site B. Cutting and reshaping the landside levee slope, constructing a landside stability berm, and restoring the levee crown would affect only the levee. The comments for Site A cultural resources considerations are also valid for Site B.

C-103979

C-103979

The Colusa Basin drainage canal must be evaluated for National Register eligibility.

Site C. A significant archeological site, Tyndall Mound (CA-Yol-5), has been identified at this location. Although Tyndall Mound has sustained some damage from past construction activities, Yol-5 likely retains sufficient integrity to make it eligible for nomination to the National Register of Historic Places. Archeological testing would be necessary to identify site limits and to permit National Register evaluation. As project design is finalized, mitigation measures must be developed and an appropriate agreement document prepared among the Corps, State Historic Preservation Officer, Advisory Council on Historic Preservation, and other interested parties. In addition, because of the high potential for the presence of burials at this prehistoric habitation site, it would be necessary to consult with the appropriate Native American group(s) in accordance with the Native American Graves Protection and Repatriation Act of 1990.

Site D. Proposed construction activities at this site, including addition of a 20-foot-wide landside berm, would affect only the levee. Evaluation of the levee for National Register eligibility is the only cultural resource concern at this time.

Site E. Proposed construction activities at this site would be the same as those proposed for Site D. However, construction in areas close to ramps or existing residential or farm buildings would be avoided. Cultural resource concerns are the same as for Site D. However, several old corrals and a shed are proposed for demolition. These structures must be evaluated for eligibility for listing on the National Register of Historic Places prior to demolition.

7.7 Rare, Threatened, and Endangered Species.

Without Project. Under this alternative, current conditions or trends would remain unchanged; therefore, no immediate impacts on listed species are expected. If severe levee failure were to occur at some future date, it is possible that existing listed species would be lost and their associated habitats would be damaged or completely removed by floodwaters and erosion.

With Project. A brief description of potential impacts to listed threatened and endangered species in the study area is given below. Adverse effects could result from the direct physical destruction of sensitive species or degradation of habitat during construction activities. More detailed information is contained in the FWS Planning Aid Report (Appendix B), and impacts to listed species would be examined further in a biological data report.

The Federally listed endangered winter-run chinook salmon and threatened delta smelt would not be adversely affected by

the proposed project because no waterside levee improvements would be constructed. The Federally listed threatened giant garter snake, endangered palmate-bracted bird's-beak, and endangered Butte County (Shippee) meadowfoam may be adversely affected by irrigation ditch relocation. The Federally listed endangered Antioch Dunes evening-primrose and Contra Costa wallflower may be adversely affected by construction of stability berms, seepage control structures, and relocation of irrigation drainage ditches. Construction activities involving tree removal may disturb the Federally listed endangered bald eagle, the State-listed threatened Swainson's Hawk and bank swallow, and the State-listed endangered willow flycatcher and yellow-billed cuckoo. Removal of elderberry bushes could adversely affect the Federally listed threatened valley elderberry longhorn beetle. Construction activities near agricultural fields may disrupt the Federally listed threatened Aleutian Canada goose. However, the Corps would avoid construction activities that may affect Federal or State-listed species whenever possible. Further evaluation, including field surveys to determine actual presence of the species in the area, would be conducted in a biological data report.

8.0 **Mitigation**. This section discusses mitigation needs and costs for the project. Environmental impacts associated with the project were discussed in Section 7.0. The FWS has developed mitigation measures and associated costs for fish and wildlife resources based on the potential impacts discussed in Section 7.0 (Table 3). These measures would be refined by conducting a HEP analysis at each site after future advanced engineering and design studies. For the Initial Appraisal Report, only minimal field work was conducted by FWS to quantify the impacts on the affected habitats. Therefore, the figures in Table 3 are preliminary estimates of mitigation needs. Mitigation estimates are based on acres of affected habitat and do not include the costs of land acquisition. FWS mitigation requirements would be reexamined in a HEP after other methods, including avoiding or minimizing the impacts, have been fully considered by the Corps.

8.1 **Air Quality**. Short-term degradation of air quality due to construction is considered a short-term unavoidable impact. To reduce the emissions of construction machinery, routine maintenance of all construction equipment after every 250 hours of operation would be required. In addition, the contractor would be required to control dust/particulate generation from earthwork activities and airborne slurry particles from the cutoff wall construction alternative. Staging areas would be located throughout the project area in order to minimize disturbance to residential areas and impacts to air quality. By locating staging areas throughout the project, the number of trips required for construction will be fewer and of shorter duration. No mitigation for air quality is necessary.

C-103981

C-103981

8.2 **Water Quality**. Irrigation drainage ditches would be relocated prior to filling the existing ditches. All refueling activities would be prohibited from waterside areas. Construction and staging areas would be fully contained with barriers and dikes to prevent any material from entering the Sacramento River or Colusa Basin Drain. All of the proposed levee modification alternatives consist of structural reconstruction to the internal portion of the levee (cutoff wall through the levee crown) or on the landward side of the levee. Construction activities would be confined to the levee crown or the landside of the levee where possible. No work would be done in the Sacramento River or Colusa Basin Drain; however, irrigation, municipal, or river water may be used for construction purposes. No impacts to water quality are anticipated so no mitigation is necessary.

8.3 **Land Use**. Land owners would be financially compensated for loss of property due to construction activities. FWS recommends that agricultural land replacement ratios be 1.5:1. Therefore, mitigation for elimination of 54 acres of rice fields could amount to in-kind revegetation of 81 acres; losses of 9.5 acres of orchard lands could be mitigated by in-kind creation of 14.3 acres. These habitats could also be replaced out-of-kind with higher value habitats, which would likely result in lower compensation ratios. The costs of this plan are currently unknown and would be developed in the HEP (FWS, 1995). However, agricultural areas are intensively and artificially managed so they do not provide significant wildlife values. Therefore, the wildlife value for these areas may actually increase as a result of this project because the agricultural lands will no longer be farmed and natural vegetation would be reestablished.

8.4 **Fish**. Compensation for impacts to fish populations and other aquatic resources would need to be addressed should the project involve waterside construction (FWS, 1995). Currently no waterside work has been proposed. Emergent marsh habitats in irrigation drainage ditches would be replaced on site as recommended by FWS and would be self-mitigating for existing aquatic resources. No offsite mitigation would be required for irrigation ditch relocation.

8.5 **Vegetation and Wildlife**. The Corps would avoid adversely affecting vegetation and wildlife wherever possible. Compensation requirements would be further examined in a Environmental Assessment by the Corps and a HEP analysis by FWS.

To compensate for adverse impacts to a total of 7.32 acres of riparian woodland in the project area, the FWS recommends 21.96 acres (3:1 replacement ratio) be replanted to offset habitat losses for wildlife. Plantings of native woody riparian species (trees and shrubs) would be required in the area to replace lost habitat values. Estimated costs to replace riparian vegetation typically amount to $25,000 per acre, excluding land acquisition, resulting in a total of $549,000

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revegetation costs. Irrigation (a drip system) is recommended for a minimum of 3 years, or until the plantings are well established and self-sustaining. Any dead or deteriorating plantings would be replaced and maintained until well established. The FWS recommends monitoring the newly established vegetation for a period of 10 years to determine the success of the plantings (FWS, 1995). Mitigation for vegetation and wildlife would be provided by acquiring a parcel of land that could be revegetated with the appropriate types of wildlife habitat. The land would require a water source, and the soil must be suitable for the proposed habitats and species.

FWS recommends that the 11 trees that would be removed be replaced at a ratio of at least 5:1, for a total replacement need of 55 trees. FWS further recommends that all plantings be watered and maintained until they are established, and that drip irrigation be an efficient watering method. In previous Corps projects, FWS has recommended a ratio of 3:1 compensation for individual trees with 3 years of irrigation and maintenance of plantings. The mitigation requirements including the cost of this plan would be further refined and developed in the HEP.

To offset the adverse impacts to 5.6 acres of freshwater emergent marsh, FWS recommends that an estimated 8.4 acres be established, based on a replacement ratio of 1.5:1. Total revegetation costs would be about $42,000 (8.4 acres x $5,000) (FWS, 1995). Drainage ditches would be reconstructed as part of the project. If replacement ditches are reconstructed prior to filling the existing ditches, FWS reports that adverse effects to emergent marsh would likely be minimal, and no additional mitigation would be necessary (FWS, 1995). If the replacement ditches are constructed at the same time or after filling the existing ditches, FWS reports that mitigation of emergent marsh habitat would be required (FWS, 1995). However, the ditches carry water only during irrigation periods and are dry when no irrigation takes place. Therefore, emergent marsh habitat may not be present during parts of the year, and irrigation ditches could be replaced during dry periods without adversely affecting emergent marsh habitat.

FWS recommends that annual grassland areas disturbed by construction activities be reseeded with various grasses and forbs (native species if possible). Grasses and forbs would be seeded at a rate appropriate for species and conditions, but generally not less that 30 pounds of seed per acre. Areas to be seeded would be disced and sown in early fall, as soon after construction as possible, to promote germination and establishment during the ensuing rainy season. An estimated 259 acres of grassland habitat would be disturbed by borrow and associated construction access. The cost of such grassland seeding is estimated to be $800 to $1,000 per acre. FWS estimated that post-construction reseeding of grasses on the construction areas, including the levee slopes, would offset project impacts to grasslands, resulting in no overall loss of this habitat type (FWS, 1995). Reseeding of annual grassland

C-103983

C-103983

would be done as a routine construction activity by the Corps; therefore, no mitigation is necessary.

The FWS recommends that loss of wetland values associated with rice fields could be offset through establishment of emergent marsh. Emergent marsh could be established within the irrigation ditches to be replaced. The ditches could be widened to accommodate additional vegetation. The replacement ratio of this plan would be about 1:1.

8.6 **Cultural Resources**. Consultation with the SHPO would be initiated to determine what additional work should be completed in accordance with section 106 of the National Historic Preservation Act of 1966. As part of future studies, intensive cultural resources surveys may be needed to obtain current information on the condition of previously recorded sites and to identify other cultural properties within the project area. Once the extent and specific locations of construction activities are determined, mitigation of impacts to cultural resources would be accomplished under a Memorandum of Agreement between the Corps, the non-Federal sponsor, the SHPO, and the Advisory Council on Historic Preservation as required by Section 106 of the National Historic Preservation Act of 1966, as amended; 36 CFR 800; and ER 1105-2-100. Consideration must first be given to selecting project alternatives that would allow for the avoidance or preservation of significant cultural resources.

8.7 **Rare, Threatened, and Endangered Species**. Specific impacts to the Federally listed endangered winter-run chinook salmon, bald eagle, palmate-bracted bird's-beak, Contra Costa wallflower, Butte County (Shippee) meadowfoam, Antioch Dunes evening-primrose, and the threatened delta smelt, giant garter snake, Aleutian Canada goose, and valley elderberry longhorn beetle would be determined in advanced engineering and design studies as specific design information is available. A biological data report and biological assessment would be prepared for Phase V to assess the project impacts on any Federally endangered or threatened species found at a specific project site. Required mitigation measures would be developed in coordination with the FWS, who would then issue a biological opinion on any impacts to listed species. A favorable biological opinion would allow these mitigation measures to be implemented.

The following FWS recommendations are provided pursuant to Section 7 of the Endangered Species Act for listed endangered and threatened species that may occur in the area or may be affected by the proposed Phase V project.

a. Determine potential effects of the project on listed or proposed species or critical habitat by conducting surveys for the species of potential habitat, as appropriate.

b. Should the species or critical habitat be present, complete a biological assessment for the project and determine whether the species would be affected.

c. To reduce the likelihood of the species being adversely affected by the project, modify the construction designs to reduce or eliminate the effects.

d. Should the proposed action be likely to affect the species or its critical habitat, initiate formal consultation with the FWS.

If waterside construction is proposed, consultation with the National Marine Fisheries Service under Section 7 of the Endangered Species Act would be initiated for any activities which may adversely affect the winter-run chinook salmon or delta smelt.

A formal list of State-listed species that may occur in the project area would be obtained from the California Department of Fish and Game prior to construction. FWS recommends that the Corps survey construction sites during the spring and summer prior to construction to determine whether Swainson's hawks are nesting in the project area. These surveys would include evaluation of nesting sites and territories. The Department of Fish and Game would determine if nests are likely to be affected by construction activities. To avoid potential construction activity effects to Swainson's hawk, construction activities would be conducted in accordance with guidelines provided by DFG.

9.0 **Future Studies**. A programmatic EIS/EIR has been prepared that discusses the general environmental impacts of Phases II-V of the Sacramento River Flood Control Systems Evaluation Project. Supplemental environmental documents will be prepared for Phase V during advanced engineering and design studies as specific design information is available.

For Phase V, supplemental environmental studies would include preparation of an environmental assessment, a biological assessment, a Coordination Act Report, a HEP analysis, and formal consultation with the FWS Endangered Species Office if the project is found to adversely affect any listed species. Additional surveys may need to be conducted to determine if the Palmate-bracted bird's-beak, valley elderberry longhorn beetle, giant garter snake, and bald eagle occur in the project area by qualified biologists. Preparation of an Environmental Assessment is tentatively scheduled to begin in 1996. Preparation of a 404 (b)(1) Water Quality Evaluation would also be required if construction activities occur in the Sacramento River or any other jurisdictional wetlands. A streambed alteration permit may be required for waterside construction activities. A survey for hazardous, toxic, and radiological waste sites should be performed prior to construction.

In addition, the State-listed Swainson's hawk, willow flycatcher, yellow-billed cuckoo, and bank swallow are known to nest in the project area. The local sponsor may need to consult with the Department of Fish and Game to develop a mitigation plan for the Swainson's hawk and bank swallow.

C-103986

C-103986

10.0 List of Preparers.

Name/ Expertise	Experience	Role in Preparation
Lee Foster Archaeologist	3 years engineering and planning studies, Corps of Engineers	Cultural resources
Craig Gaines Project Manager	8 years engineering and planning studies, Corps of Engineers; 13 years private consulting	Report review
Debbie Giglio Biological Sciences Environmental Manager	3 years planning studies, Corps of Engineers	Report preparation and research
Susan Ramos Chief, Environmental Planning Section	5 years planning studies, Corps of Engineers; 5 years Bureau of Reclamation; 4 years Environmental Protection Agency	Report review
Lynne Stevenson Technical Writer/Editor	9 years planning studies, Corps of Engineers; 10 years professional librarian	Report organization and review

C—103987

C-103987

11.0 Literature Cited.

Bean, Walton. 1968. California: An Interpretive History. McGraw-Hill, Inc., New York.

Beck, Warren A. and David A. Williams. 1972. California: A History of the Golden State. Doubleday and Company, Inc., Garden City, New York.

Bouey, Paul D. 1989. Cultural Resources Inventory and Evaluation: Sacramento River Bank Protection (Unit 44) Project. Far Western Anthropological Research Group, Inc. Report on file at Sacramento District, Corps of Engineers.

Colusa County Agricultural Commissioner's Office. 1995. Phone conversation 2/2/95.

Environmental Protection Agency. 1993. California Environmental Protection Agency Air Resources Board Area Designations for State and National Ambient Air Quality Standards. Technical Support Division Air Quality Data Branch Air Quality Data Review Section. Environmental Protection Agency.

Goldschmidt, Walter. 1978. "Nomlaki." Handbook of North American Indians, Volume 8, California. ed. Robert Heizer. Smithsonian Institution, Washington, D.C.

Haller, John M. 1957. Tree Care. The Macmillan Company, NY.

Harris, Richard W. 1983. Arboriculture: Care of Trees, Shrubs, and Vines in the Landscape. Prentice-Hall, Inc., NY.

Heely, Terry. 1994. Phone conversation 11/30/94. Department of Fish and Game, Tehama County, CA.

Johnson, Jerald J. 1974. Reconnaissance Archeology Survey of 161 Locations on the Sacramento River Drainage from Elder Creek in the North to Rio Vista in the South. Report on file at the U.S. Army Corps of Engineers District Office, Sacramento.

Johnson, Patti J. 1978. "Patwin." Handbook of North American Indians, Volume 8, California. ed. Robert Heizer. Smithsonian Institution, Washington, D.C.

Johnson, Jerald J. and Patti Johnson. 1974. Cultural Resources along the Sacramento River from Keswick Dam to Sacramento. Report prepared for Sacramento District, Corps of Engineers.

Kelley, Robert. 1989. Battling the Inland Sea. University of California Press, Berkeley.

Moratto, Michael J. 1984. California Archeology. Academic Press, Orlando.

Riddell, F.A. 1978. "Maidu and Konkow." Handbook of North American Indians, Volume 8, California. ed. Robert Heizer. Smithsonian Institution, Washington, D.C.

Shapiro, Lisa A. 1992. Cultural Resources Inventory for the Colusa Basin/Knights Landing Ridge Cut Levees Project, Colusa and Yolo Counties, California. Report on file at the U.S. Army Corps of Engineers District Office, Sacramento.

U.S. Army Corps of Engineers. 1959. Design Memorandum No. 4, Sacramento River and Major and Minor Tributaries, Elder Creek General Design, U.S. Army Corps of Engineers, Sacramento.

U.S. Army Corps of Engineers. 1963. Sacramento River and Major and Minor Tributaries Project, California Operation and Maintenance Manual for Elder Creek from Sacramento River to High Ground. U.S. Army Corps of Engineers, Sacramento.

U.S. Army Corps of Engineers. 1993. Sacramento River Flood Control System Evaluation Initial Appraisal Report - Lower Sacramento Area. U.S. Army Corps of Engineers, Sacramento.

U.S. Army Corps of Engineers. 1991. Sacramento River Flood Control System Evaluation Initial Appraisal Report - Mid-Valley Area. U.S. Army Corps of Engineers, Sacramento.

U.S. Army Corps of Engineers. 1992a. Sacramento River Flood Control System Evaluation Phase II - Marysville/Yuba City Area Draft Environmental Assessment Initial Study. U.S. Army Corps of Engineers, Sacramento.

U.S. Army Corps of Engineers. 1992b. Sacramento River Flood Control System Evaluation Phases II-V. Programmatic Environmental Impact Statement/Environmental Impact Report. U.S. Army Corps of Engineers, Sacramento.

U.S. Fish and Wildlife Service. 1995. Draft Planning Aid Report. U.S. Fish and Wildlife Service, Sacramento.

U.S. Fish and Wildlife Service. 1994. Endangered Species List. U.S. Fish and Wildlife Service, Sacramento.

U.S. Fish and Wildlife Service. 1990. Sacramento River Flood Control System Evaluation, Phase V. Planning Aid Letter. U.S. Fish and Wildlife Service Ecological Resources, Sacramento.

Werner, Roger H. 1988. Cultural Resources Inventory and Evaluation, Sacramento River Bank Protection Project, Units 42 and 43. Report on file at the U.S. Army Corps of

C-103989

C-103989

Engineers District Office, Sacramento.

Whitcomb, Carl E., Ph.D. 1991. Establishment and Maintenance of Landscape Plants. Lacebark, Inc., IL.

Yolo County Agriculture Commissioner Office. 1995. Phone conversation 2/2/95.

C-103990

C-103990

Appendix A

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-94-SP-1393

August 3, 1994

Mr. Walter Yep
Chief, Planning Division
U.S. Army Corps of Engineers, Sacramento
1325 J Street
Sacramento, California 95814-2922

Subject: Species List for Proposed Sacramento River Flood Control Systems Evaluation Project, Phase V, Knights Landing to Tisdale Bypass, Tehama, Butte, Glenn, Sutter, Colusa and Yolo Counties, California

Dear Mr. Yep:

As requested by letter from your agency dated July 5, 1994, you will find enclosed a list of listed, proposed and candidate species that may be present in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended, (ACT).

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

We have included the candidate species that may be present in the project area (see Enclosure A). These species are currently being reviewed by our service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

If the proposed project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by the U.S. Army Corps of Engineers (Corps), a Corps permit shall be required, pursuant to section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act. Impacts to wetland habitats require site specific mitigation and monitoring. You may request a copy of the Service's General Mitigation and Monitoring Guidelines or submit a detailed description of the proposed impacts for specific comments and recommendations.

We appreciate your concern for endangered species. If you have further questions, please call Laurie Stuart Simons of this office at (916) 978-5408 extension 330. If you have any questions regarding wetlands, contact Mike Aceituno at (916) 978-5408 extension 350.

For questions concerning the endangered winter-run chinook salmon, please contact Jim Lecky, Endangered Species Coordinator, at the National Marine Fisheries Service, Southwest Region, 501 West Ocean Boulevard, Suite 4200, Long Beach California 90802-4213, or call him at (310) 980-4015.

Sincerely,

Laurie Simons

for Joel A. Medlin
Field Supervisor

Enclosures

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OR MAY BE AFFECTED BY THE PROPOSED SACRAMENTO RIVER FLOOD CONTROL SYSTEMS EVALUATION PROJECT, PHASE V, KNIGHTS LANDING TO TISDALE BYPASS, TEHAMA, BUTTE, GLENN, SUTTER, COLUSA and YOLO COUNTIES, CALIFORNIA
(1-1-94-SP-1393, AUGUST 3, 1994)

Listed Species

Fish
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
delta smelt, *Hypomesus transpacificus* (T)

Reptiles
giant garter snake, *Thamnophis gigas* (T)

Birds
bald eagle, *Haliaeetus leucocephalus* (E)
Aleutian Canada goose, *Branta canadensis leucopareia* (T)

Invertebrates
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

Plants
palmate-bracted bird's-beak, *Cordylanthus palmatus* (E)
Contra Costa wallflower, *Erysimum capitatum* ssp. *angustatum* (E)
Butte County (Shippee) meadowfoam, *Limnanthes floccosa* ssp. *californica*(E)
Antioch Dunes evening-primrose, *Oenothera deltoides* ssp. *howellii* (E)

Proposed Species

Fish
Sacramento splittail, *Pogonichthys macrolepidotus* (PT)

Amphibians
California red-legged frog, *Rana aurora draytonii* (PE)

Plants
Stebbins' morning-glory, *Calystegia stebbinsii* (PE)
Pine Hill ceanothus, *Ceanothus roderickii* (PE)
Hoover's spurge, *Chamaesyce hooveri* (PT)
Pine Hill flannelbush, *Fremontodendron californicum* ssp. *decumbens* (PE)
El Dorado bedstraw, *Galium californicum* ssp. *sierrae* (PE)
Colusa grass, *Neostapfia colusana* (PT)
pilose Orcutt grass, *Orcuttia pilosa* (PE)
slender Orcutt grass, *Orcuttia tenuis* (PT)
Hartweg's golden sunburst, *Pseudobahia bahiifolia* (PE)
Layne's butterweed, *Senecio layneae* (PT)
Greene's tuctoria, *Tuctoria greenei* (PE)

Candidate Species

Fish

green sturgeon, *Acipenser medirostris* (2R)
longfin smelt, *Spirinchus thaleichthys* (2)

Amphibians

western spadefoot toad, *Scaphiopus hammondi hammondi* (2R)
foothill yellow-legged frog, *Rana boylii* (2)

Reptiles

California tiger salamander, *Ambystoma californiense* (1)
northwestern pond turtle, *Clemmys marmorata marmorata* (2)
southwestern pond turtle, *Clemmys marmorata pallida* (2)

Birds

tricolored blackbird, *Agelaius tricolor* (2)
loggerhead shrike, *Lanius ludovicianus* (2)

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)
greater western mastiff-bat, *Eumops perotis californicus* (2)
San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (2)
San Joaquin Valley woodrat, *Neotoma fuscipes riparia* (2)
spotted bat, *Euderma maculatum* (2)
Marysville Heerman's kangaroo rat, *Dipodomys californicus (=heermanni) eximus* (2)

Invertebrates

Sacramento Valley tiger beetle, (*Cicindela hirticollis abrupta*) (2R)

Plants

Suisun Marsh aster, *Aster lentus* (2)
Ferris's milk-vetch, *Astragalus tener* var. *ferrisiae* (2)
alkali milk-vetch, *Astragalus tener* var. *tener* (2R)
heartscale, *Atriplex cordulata* (2)
brittlescale, *Atriplex depressa* (2R)
big tarplant, *Blepharizonia plumosa* ssp. *plumosa* (2R)
Fremont's rosinweed, *Calycadenia fremontii* (2)
Butte County morning-glory, *Calystegia atriplicifolia* ssp. *buttensis* (2)
Red Hills soaproot, *Chlorogalum grandiflorum* (2)
Mosquin's clarkia, *Clarkia mosquinii* ssp. *mosquinii* (2)
Enterprise clarkia, *Clarkia mosquinii* ssp. *xerophila* (2)
hispid bird's-beak, *Cordylanthus mollis* ssp. *hispidus* (2)
soft bird's-beak, *Cordylanthus mollis* ssp. *mollis* (1)
silky cryptantha, *Cryptantha crinita* (2)
recurved larkspur, *Delphinium recurvatum* (2)
diamond-petaled poppy, *Eschscholzia rhombipetala* (2)
Butte fritillary, *Fritillaria eastwoodiae* (2)
fragrant fritillary, *Fritillaria liliacea* (2)
adobe lily, *Fritillaria pluriflora* (2)
Brewer's dwarf-flax, *Hesperolinon breweri* (2)
Northern California black walnut, *Juglans californica* var. *hindsii* (2)
Ahart's rush, *Juncus leiospermus* var. *ahartii* (1)

Plants Continued

Contra Costa goldfields, *Lasthenia conjugens* (1)
delta tule-pea, *Lathyrus jepsonii* var. *jepsonii* (2)
legenere, *Legenere limosa* (2)
Mason's lilaeopsis, *Lilaeopsis masonii* (2)
veiny monardella, *Monardella douglasii* ssp. *venosa* (2)
Ahart's whitlow-wort, *Paronychia ahartii* (2)
closed-lip (closed-throated) beardtongue, *Penstemon personatus* (2)
Gairdner's yampah, *Perideridia gairdneri* ssp. *gairdneri* (2)
California beaked-rush, *Rhynchospora californica* (2)
valley sagittaria, *Sagittaria sanfordii* (2)
Tracy's sanicle, *Sanicula tracyi* (2)
Butte County sidalcea, *Sidalcea robusta* (2)
Butte County (western) catchfly, *Silene occidentalis* ssp. *longistipitata* (2)
showy Indian clover, *Trifolium amoenum* (1R)
caper-fruited tropidocarpum, *Tropidocarpum capparideum* (2*)
El Dorado mule-ears, *Wyethia reticulata* (2)

(E)--Endangered (T)--Threatened (P)--Proposed (CH)--Critical Habitat
(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(1R)-Recommended for Category 1 status.
(2R)-Recommended for Category 2 status.
(■)--Listing petitioned.
(*)--Possibly extinct.

Appendix B

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

April 5, 1995

Colonel John N. Reese
District Engineer
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Subject: CESAC--Sacramento River Flood Control System Evaluation, Phase V

Dear Colonel Reese:

Enclosed is the Fish and Wildlife Service's planning aid report for the Corps of Engineers' Sacramento River Flood Control System Evaluation, Phase V. This report is provided pursuant to the Scope of Work between our agencies for Fiscal Year 1995. A draft copy of this report was sent to the agencies listed below for their review; their comments have been incorporated into this final report, where appropriate.

In summary, impacts to four habitat types and several individual trees were identified. For this preliminary analysis, we quantified mitigation compensation based on estimated replacement ratios. Following is an estimate of impacts and compensation needs for the project. It should be noted, however, that these compensation recommendations do not supercede our primary recommendation to avoid or reduce impacts to the most high value habitats (in this case, riparian woodlands and freshwater emergent marsh). For impacts to 7.32 acres of riparian woodland, 5.6 acres of freshwater emergent marsh, 54 acres of rice fields, 9.5 acres of orchards, and about 11 individual trees we have provided preliminary compensation recommendations of 22 acres of riparian woodland, 8.4 acres of freshwater emergent marsh, 95 acres of agricultural lands or other habitats, and 55 individual trees.

We appreciate the opportunity to provide input to your planning process. For further coordination regarding this project, please contact Ginger Kemis of my staff at (916) 979-2107.

Sincerely,

Joel A. Medlin
Field Supervisor

cc: FWS, ARD-ES, Portland, OR
NMFS, Santa Rosa, CA (Attn: Jim Bybee)
CDFG, Reg. Mgr., Region II, Rancho Cordova
CDFG, Environmental Services, Sacramento
DWR, Environmental Services, Sacramento

UNITED STATES DEPARTMENT of the INTERIOR

FISH AND WILDLIFE SERVICE

PLANNING AID REPORT

FOR THE

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION PHASE V

PREPARED FOR

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

APRIL 1995

C-103999

C-103999

TABLE OF CONTENTS

I. INTRODUCTION 1

II. BACKGROUND 1

III. DESCRIPTION OF PROJECT ALTERNATIVES 2

IV. DESCRIPTION OF THE AREA 4

V. BIOLOGICAL RESOURCES 5
A. EXISTING CONDITIONS 5
1. Vegetation 5
2. Fish 7
3. Wildlife 9
4. Threatened and Endangered Species 10
a. Plants 10
b. Invertebrates 10
c. Fish 11
d. Reptiles 11
e. Birds 12
f. Proposed Species 12
g. Candidate Species 13
h. State-Listed Species 13

VI. IMPACT ASSESSMENT 13
A. METHODOLOGY 13
B. RESULTS 13
2. Specific Impacts 15
a. Site A 16
b. Site B 16
c. Site C 16
d. Site D 16
e. Site E 16

VII. DISCUSSION 16
A. MITIGATION PLANNING GOALS 16
1. Riparian Woodland 18
2. Freshwater Emergent Marsh 18
3. Annual Grassland 18
4. Agricultural Land 19
B. MITIGATION 19

RECOMMENDATIONS 20

LITERATURE CITED 22

LIST OF APPENDICES 25
APPENDIX A
U.S. ARMY CORPS OF ENGINEERS'
PROJECT DESCRIPTION 26
APPENDIX B
THREATENED AND ENDANGERED SPECIES
INFORMATION 31

LIST OF TABLES

TABLE 1.
Projected habitat losses, by construction site, Sacramento River Flood Control System Evaluations, Phase V. 14

LIST OF FIGURES

FIGURE 1.
Proposed work sites, Sacramento River Flood Control Systems Evaluation, Phase V. 3

I. INTRODUCTION

This is the Fish and Wildlife Service's (Service) planning aid report (PAR) on the Army Corps of Engineers' (Corps) proposed Sacramento River Flood Control System Evaluation, Phase V. As described in the Scope of Work for fiscal year 1995, this report (1) describes the fish and wildlife resources of the Sacramento River from Knights Landing (River Mile 90) to just upstream of Colusa (River Mile 143) and the Colusa Basin Drainage Canal, (2) describes the potential impacts of remedial levee repair alternatives on these resources, (3) gives an estimate of compensation needs to offset these impacts, and (4) presents alternatives to avoid or minimize impacts of the anticipated project design.

The information provided herein is preliminary in nature and is provided as technical assistance to aid your planning process. It does not constitute our detailed report as required by Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended U.S.C et seq) (FWCA). This analysis is based on project information provided by the Corps through March 1995, site visits, and information in existing files at the Service's Sacramento Field Office. Our recommendations provided herein are based on mitigation and compensation commensurate with the fish and wildlife values involved and adhere to the sequential levels identified by the Council on Environmental Quality.

This letter has been coordinated with the California Department of Fish and Game and the National Marine Fisheries Service. All preliminary information presented herein regarding endangered, threatened and candidate species has been coordinated with our Habitat Conservation staff.

II. BACKGROUND

The Sacramento River Flood Control Project, authorized by the Flood Control Act of 1917 and subsequent Acts, consists of approximately 1,000 miles of levees, plus overflow weirs, pumping plants and bypass channels, which provide flood protection for residential communities and agricultural lands in the Sacramento Valley and Sacramento - San Joaquin Delta (Jones and Stokes 1987). The present Corps levee system evaluation is being conducted to determine the long-term integrity of the existing flood control system for the Sacramento River and its tributaries. It was initiated subsequent to the 1986 flood event which severely stressed the existing levee system in the study area, caused some levee failures, and hence, raised the question of levee reliability.

The Sacramento River Flood Control System Evaluation, authorized by the Energy and Water Development Appropriation Act of 1987, is divided into five phases, roughly separated by geographic area, as described below.

Phase I - Levees in the Sacramento urban area.

Phase II - Both banks of the Feather River; levees around Marysville/Yuba City, Wadsworth Canal, Sutter Bypass, and a portion of Bear River.

Phase III - The lower Feather River; the Sacramento River from Tisdale Bypass to just below the Fremont Weir; the right bank of the Sutter Bypass from Tisdale Bypass to the Fremont Weir; the left bank of the Yolo Bypass from the Sacramento Bypass to the Fremont Weir; and the left bank of Knights Landing Ridge Cut.

C-104002

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Phase IV - Levees along the Sacramento River from Freeport south to the Delta (at Collinsville); all other Sacramento River Flood Control Project levees in the Delta.

Phase V - The Upper Sacramento River above the Phase III area and right bank of Sutter Bypass above Tisdale Bypass, North levee of Tisdale Bypass, Cherokee Canal, Elder Creek, Butte Creek, Deer Creek, Sycamore Trough, right of the Knights Landing Ridge Cut and the Colusa Basin Drain. **The analysis contained within this report pertains only to identified sites located on the Sacramento River and the Colusa Basin Drain.** No sites at the other listed locations have been identified for construction by the Corps.

III. DESCRIPTION OF PROJECT ALTERNATIVES

Specifically, Phase V construction would consist of levee reconstruction at up to five sites--three along the Sacramento River from Knights Landing (River Mile 90) to Colusa (River Mile 143), and two along the Colusa Drain just west of Knights Landing (Figure 1). The design methods proposed at each site depend on the geology of the site, structure of the existing levee and the type and extent of repairs required. Project construction is designed to correct any subsidence, structural stability, seepage, and piping problems associated with the site. Alternatives would be constructed landward of the levee.

Anticipated design methods would consist of one of the following at each site: 1) construction of a landside stability berm in combination with ditch relocation, 2) construction of a landside stability berm in combination with a toe drain, or 3) levee crown restoration. In addition, construction of a cement bentonite cutoff (slurry) wall within the existing levee is being considered as a less environmentally-damaging alternative at some sites.

The Corps' detailed description of the design alternatives proposed at each site is presented in Appendix A. A general description of the anticipated design and potential alternative designs being considered by the Corps at each site is as follows:

A. Site A

Site A is located along 15,500 LF of the Colusa Drain, from about 1.5 miles west of Knights Landing Ridge Cut west to Road 99A. Proposed work at the Site would consist of construction of a landside stability berm, lime treatment of the levee crown and slopes, and relocation of an irrigation drainage ditch.

Alternatives proposed to minimize negative impacts of project construction to fish and wildlife at this site consist of reshaping the landside levee slope and not relocating the ditch. Additionally, levee crown restoration would occur in the same area.

B. Site B

Site B is a 5.5 mile reach located along the Colusa Drain, running west from Road 99A. Proposed work at the site consists of landside berm construction and drainage ditch relocation. Additionally, levee crown restoration would take place along 3,200 linear feet of the reach. According to the Corps' project description (Appendix A), construction could possibly be modified to further reduce impacts to fish and wildlife habitat by varying the width of the landside berm and the levee slope.

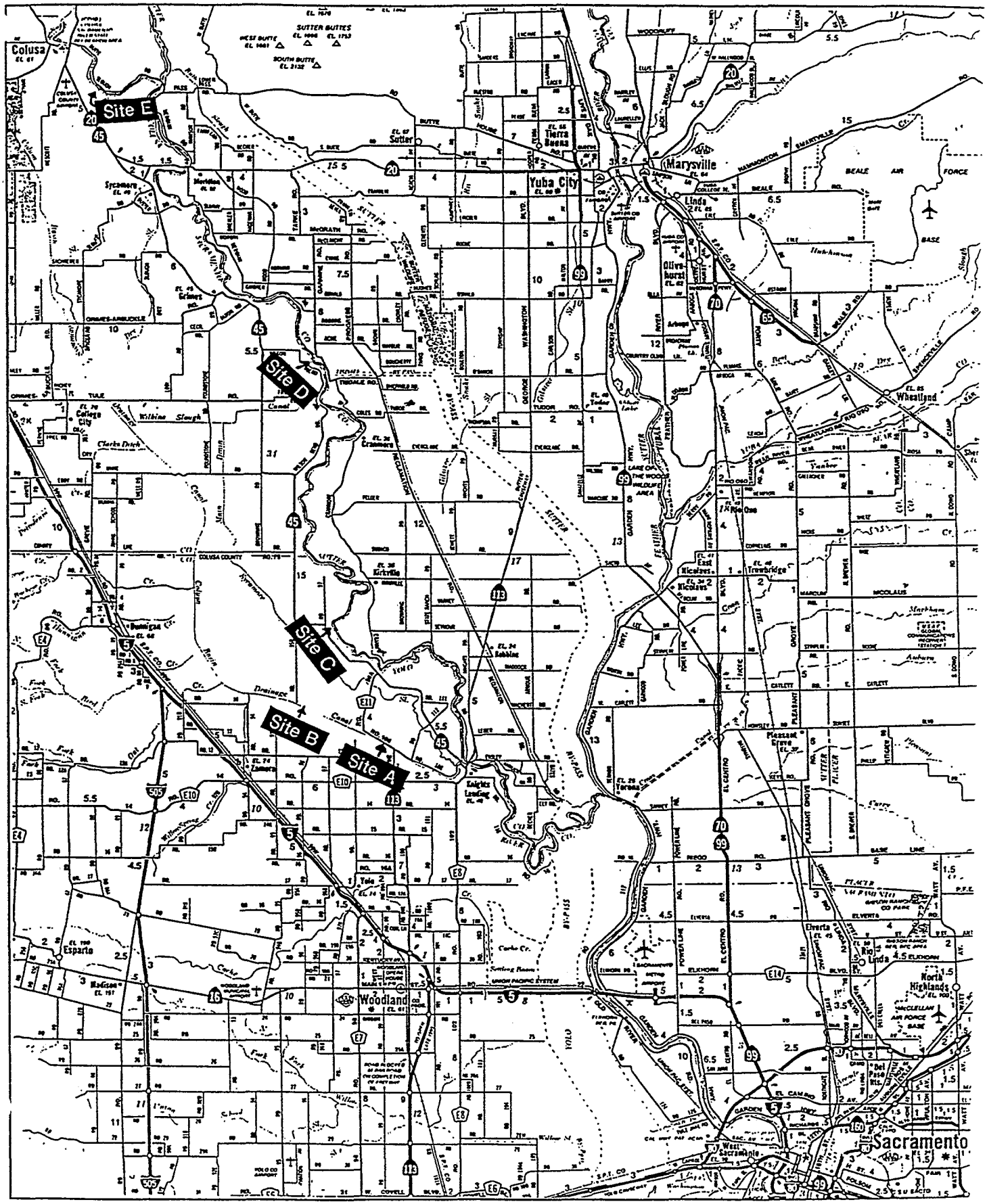

Figure 1. Proposed work sites, Sacramento River Flood Control System Evaluation, Phase

C. Site C

Site C is located on the right bank of the Sacramento River, RM 101.80 to 102.05. At this site, proposed work consists of placing about 2 to 3 feet of soil on the levee crown for levee crown restoration along a 1,300 linear foot reach. An alternative design is being considered to protect rice storage bins located at the site, which would consist of construction of a flood wall and reshaping of the waterside levee face near the water's edge. The latter alternative is not a method to reduce environmental impacts at the site.

D. Site D

Site D is located along 2,700 linear feet of the Sacramento River, between River Mile 119.1 and 119.6 on the right bank. Proposed construction at the site consists of the addition of a landside berm to about the bottom one third of the levee, with a drain at the base of the levee to control seepage. Two alternatives may also be considered to minimize biological impacts at this site: 1) a slurry wall could be constructed in lieu of the above alternative, and 2) the berm width could be minimized and/or a portion of the tree trunks, which would otherwise be removed, could be buried. According to the Corps, implementation of the slurry wall alternative is not likely due to relatively high costs and required closure of the County Road during construction.

E. Site E

Site E is located along approximately 3.2 linear miles of the right bank of the Sacramento River, between RM 140.0 and RM 143.17. Proposed construction alternatives at this site are the same as those proposed for Site D. The slurry wall alternative could possibly be constructed along the entire reach, or limited to the area in front of residential and farm buildings.

IV. DESCRIPTION OF THE AREA

The Sacramento River system is the largest watershed in California, draining 26,300 square miles of the Central Valley, the Coast, Cascade and the Sierra Nevada mountain ranges. A system of levees bound much of the Sacramento River downstream from Chico Landing to the Delta. Flows are regulated by major dams and reservoirs, such as Shasta on the mainstem river and Whiskeytown, Oroville, New Bullards Bar, Folsom, Black Butte, and Berryessa on the tributaries. In addition, water is transferred from the Trinity River to the Sacramento River via Whiskeytown and Keswick Reservoirs. Since the construction of these storage facilities, the river is used to transport this water to the State and Federal export pump facilities in the Sacramento - San Joaquin Delta.

The sustained high-water level during the summer months, although controlled by upstream developments, contributes to some streambank erosion. The major factor contributing to the erosion of riverbanks, however, is winter flood flows. This has been attenuated due to decreasing annual precipitation and subsequent low flows for the past eight years. Two thousand square miles of fertile agricultural land and about fifty communities are located in the system's floodplain. Figure 1 shows the study area from Knights Landing to Colusa.

Prior to human encroachment upon the Sacramento River, the area from Chico Landing to Collinsville was bordered by natural levees or intermittent high banks covered with riparian forests of varied characteristics. The forests included trees of all sizes, ranging from shrub species to valley oaks and sycamores 75 to 100 feet in height, growing closely in irregular groves or belts on most of the natural levees. These groves were as much as 5 miles wide on the Sacramento River and 2 miles wide on the tributaries.

At the turn of the century, it is estimated that there were about 470,000 acres of riparian woodlands and associated plant communities along the 184 miles of the Sacramento River between Chico and Collinsville. By the 1970's, the woodlands were reduced to about 1 percent of the estimated acreage (USFWS 1976). Most of the loss was and is currently due to agricultural conversions, with other losses due to bank protection, dam and levee construction, water diversions, and timber and fuelwood harvesting.

The Colusa Drain is part of a complex system of agricultural drainwater delivery and drainage channels located in the Central Sacramento Valley (Dileanis *et al.* 1992). The drain, which acts primarily to provide drainage of agricultural water, runs roughly parallel and to the west of the Sacramento River; the drain also is used for water delivery to local agricultural areas. Much of the surrounding area is cropped in rice.

Flows within the drain fluctuate dramatically, ranging from 0 to about 1,000 cfs at various time of the year. Average annual discharge from the drain is about 251,710 acre-ft during the irrigation period (from March/April to October/November) and 71,964 acre-ft during the non-irrigation period (Dileanis *et al.* 1992). The drain receives stormwater runoff during the rainy winter months, from about October to March. Flows from the drain are deposited back into the Sacramento River at Knights Landing, or into the Yolo Bypass during high flows.

V. BIOLOGICAL RESOURCES

A. EXISTING CONDITIONS

1. Vegetation

Historically, the constant meandering, seasonal flooding, and resulting sediment deposition by the Sacramento River and associated tributaries allowed creation of a mosaic of habitat types including areas of natural levees, sloughs, oxbows, islands, marshes, riparian forest and woodlands, and extensive areas of SRA Cover. Today, the extensive habitat diversity has been lost and riparian vegetation and SRA Cover are only remnants of their historical extent.

In many areas, particularly downstream of Colusa, the remaining riverine habitats are narrow, sparse and often degraded in habitat value. Above Colusa, some larger blocks of riparian habitat, up to several hundred acres in size, are still found. Due to extensive agricultural activities throughout the Sacramento Valley, most natural habitats along the tributaries to the Sacramento River also occur in narrow strips bordering the adjacent waterways.

From Knights Landing to Colusa (River Mile 90-143), the river channel is generally constrained by levees constructed close to the river's edge. Much of the original riparian habitat has been lost, mainly due to agricultural conversions, stream channelization, and bank stabilization; the natural flow regime and sediment transport characteristics in the river channel have been altered. The remaining riparian vegetation is often degraded and generally occurs in narrow bands along the river. We approximate that less than half the original river edge vegetation remains (Storfer 1992). Where the river does meander, due to levee construction further from the river's edge, wider bands of riparian habitat exist, providing valuable habitat for hundreds of wildlife species of all classifications. Most levees are bordered by fruit and nut orchards, row and grain crops, rice fields, and open pastures, as well as scattered residential and agricultural-related structures.

Essentially four cover types are identified within the project impact area: riparian woodland, freshwater emergent marsh, annual grassland, and agricultural lands. Impacts to the cover types would result primarily from construction landside of existing levees.

Riparian woodland in the project area is defined as landside and waterside trees and/or shrubs having a canopy cover density of 20 to 70 percent. Riparian woodland in the project area contains a diversity of both native and introduced plant species, and is found at Sites A, D, and E.

At Site A, riparian woodland occurs as a narrow strip of trees along the water's edge of the Colusa Drain, and consists almost exclusively of Gooding's willow (*Salix goodingii*) with a grassy groundcover. Trees occur singly or in small clumps of two to five trees. According to the revised project design, no impacts would occur to riparian woodland at Site A. At Site D, riparian woodland consists of shrubs and relatively young trees such as Fremont's cottonwood and a variety of willow species (*Salix* sp.). Dominant woodland species at Site E include native trees and shrubs such as cottonwood, valley oak, elderberry, and willow, and non-native species such as black walnut, acacia, palm and eucalyptus. Work at Sites D and E would be constructed landside of project levees, thereby affecting both single trees and shrubs consisting mainly of valley oak, elderberry and acacia, as well as more densely wooded areas.

Freshwater emergent marsh as it exists within the project impact area, is characterized by persistent stands of herbaceous emergent vegetation; common species include giant bulrush, common cattail, peppergrass, umbrella sedge, smartweed, tarweed, and marsh pennywort. This habitat is found primarily at Sites A and B, along the drainage ditches that parallel the Colusa Drain. Freshwater emergent marsh provides feeding habitat and cover for certain waterfowl species such as pied-billed grebe, mallard and wood ducks, wading birds such as egrets and herons, and various mammals, amphibians and reptiles. In addition, marsh habitat provides an important diversity component to the adjacent waterways and agricultural fields.

Annual grassland habitat in the project area is generally associated with levees and berms, and areas beyond the landward edge of riparian woodlands. These annual grassland areas usually exist as a result of previous disruptions, such as flood control or agricultural activities, which removed native, woody riparian species and perennial grasses. This habitat persists due to grazing or maintenance activities where woody species would otherwise become established, or because of other physical characteristics of a site.

Agricultural lands within project impact areas consist predominantly of rice fields and orchards. Rice fields are found landside of project levees primarily along the Colusa Drain; orchards are found landside of project levees along the Sacramento River. Rice fields provide habitat for many species, particularly when flooded. During this time, rice fields support water-oriented birds such as herons, egrets, waterfowl, and shorebirds. Waste grains also provide feeding habitat for waterfowl, including sandhill cranes and several species of geese (Bellrose 1976).

Orchards in the project area appear to consist mostly of walnut and fruit trees. Herbaceous ground cover within the orchards typically consists of perennial or annual grasses, legumes, or bare soil, depending on cropping practices. Orchards provide certain beneficial habitat characteristics for wildlife, including perching sites for passerine birds such as mourning dove, scrub jay, and house finch, browse for rabbit and deer, and cover and shade for various bird and mammal species.

2. Fish

The Sacramento River supports a wide array of anadromous and resident fish species, both introduced and native. Key anadromous fish in the project area include chinook salmon, steelhead trout, striped bass, American shad and white sturgeon. Resident warmwater fish include largemouth bass, crappie, catfish, bluegill, tule perch and a variety of sunfish.

The Sacramento River supports the largest chinook salmon population in the state, and thus is of great importance to California's fishery. Approximately 90 percent of the Central Valley's salmon population spawns in the Sacramento River system. Four genetically distinct races of chinook salmon use the river: fall-, late-fall-, winter-, and spring-run.

Numbers of fall chinook salmon recorded at the Red Bluff Diversion Dam (RBDD) from July 1-November 24 declined from about 116,000 in 1986 to about 41,000 in 1992 (Scott Hamelberg, pers. comm.). Losses are attributable to entrainment of juveniles by huge water pumps and diversions in the Delta and along the Sacramento River, loss of suitable cover (SRA Cover) and bottom substrate (gravels) for spawning, lethal or sub-lethal water temperatures, contaminants present in the river, and other reductions in water quality. The six-year drought period from 1987-1992 has further stressed all four races, due to an increase in water temperatures and reduction of flows for both immigrating adults and emigrating juveniles.

The winter-run chinook has experienced the most precipitous decline, and was listed as a threatened species by the National Marine Fisheries Service in 1990 under emergency provisions of the Endangered Species Act of 1973. The winter-run is also listed as an endangered species under the State's similar Act. Winter-run spawning population or escapement has decreased from just under 118,000 in 1969 to only about 2,000 during the 1980's, and then to an all-time low of 191 in 1991. Numbers increased to about 1,180 fish in 1992; however, preliminary estimates for 1994 indicate escapement of about 189 fish at the RBDD (Scott Hamelberg, pers. comm.).

Winter-run are particularly susceptible to drought, as they spawn between mid-April and mid-August, thus exposing the eggs and alevins to the warmest water temperatures of the year. Successful incubation can only occur within a narrow temperature range of 42.1-57.0° F (NMFS 1992). The winter-run historically spawned in the cool waters of the McCloud River, before the construction of Shasta and Keswick Dams. After construction of these dams, spawning habitat for the winter-run was limited to the upper Sacramento River between roughly Balls Ferry Road (north of Red Bluff) and Keswick Dam.

Numbers of spring-run chinook also reflect an extremely serious decline, from 26,471 in 1969, to 773 in 1991, and recently to 388 in 1993. The spring-run spawn in tributaries such as Deer Creek and Elder Creek in Tehama County and, like the winter-run, are vulnerable to drought conditions. Fall-run chinook salmon have declined from 133,815 in 1969 to 45,629 in 1991, and then to 41,316 in 1992. Numbers of late-fall-run chinook have declined from 35,632 in 1968 to 7,089 in 1991 (Scott Hamelberg, pers. comm.).

Adult steelhead trout use the mainstem Sacramento River as a migration corridor to and from their spawning grounds. The project area provides limited areas of suitable spawning habitat for steelhead, which spawn mainly in smaller tributary streams. SRA Cover is particularly important to this species, as it is utilized by immigrating adults and emigrating juveniles. Steelhead runs have also experienced a severe decline in the Sacramento River system, mainly due to lack of flows and/or high water temperatures in tributaries, or loss of spawning habitat due to damming of spawning streams or

the compaction of spawning gravels. Numbers of steelhead recorded at the RBDD declined from 17,416 in 1968 to 2,322 in 1990, and to only 991 fish in 1991 (Scott Hamelberg, pers.comm). Estimates in 1992 revealed 4,032 steelhead at the RBDD. Because of the fluctuation in numbers associated with river conditions and salmonid life cycles, the increased count for 1992 cannot be seen as an indication of recovery of steelhead.

Second only to the salmon races, striped bass comprise one of the most important sportfishing resources in the Sacramento River system and the Delta. Important spawning areas for striped bass are located in the Delta along the section of the San Joaquin River between the Antioch Bridge and the mouth of Middle River, plus other nearby channels in the area. Another equally important spawning area is the Sacramento River between Sacramento and Colusa. Striped bass require fresh to brackish water for reproduction. Spawning occurs from April to mid-June. The eggs, which are slightly heavier than water, remain just above the channel bottom, where they are carried out to the Delta by the water currents. After the yolk sac is absorbed, the young feed on zooplankton and small invertebrates. By the second year, the young feed on small fish.

Striped bass populations have experienced a catastrophic decline. The adult population declined from about 3 million since the early 1960's, to no more than one-third, possibly one-fourth, of that number in 1980, and to about 600,000 adult fish in 1990 (DeHaven, pers. comm.). While the causes of the adult striped bass population decline are not exactly known, these declines are likely mainly due to reduction in Delta outflows and low flows in the San Joaquin River, and high salinity water at their preferred spawning areas. Such conditions adversely affect the development of eggs, larvae, and fingerlings. The Department of Fish and Game and the Service view this situation with serious concern and have been investigating means to restore the population. Three potential means to increase striped bass recruitment are: 1) provide for sufficient Delta outflows, 2) reduce pumping exports in the Delta which result in losses of eggs, larva, and young, and 3) correct existing reverse-flow problems (also caused by export pumping) in the San Joaquin River (Pat Brandes, pers. comm.).

Most of the Central Valley's American shad population spawns in the Sacramento River system. Adult shad migrate to the upper Sacramento River and larger tributaries (American, Feather, and Yuba Rivers) from March to May and spawn from May to early July. Areas with higher outflows attract most of the spawning adults; hence, production of young is typically greater in these areas. The young generally migrate to the estuary, and then to the ocean, by the end of the year. Juvenile shad are particularly vulnerable to water diversions in the southern Delta. Annual recoveries of juvenile shad at the State Water Project fish screens in the Sacramento-San Joaquin Delta and the Central Valley Project Tracy fish screens were 2,175,000 in 1968 and 559,200 in 1985 (USFWS 1990a); this coincides with a severe population decline during this time period.

Both white and green sturgeon inhabit the Sacramento River system. The green sturgeon is less abundant and its life history is less well understood. The more abundant white sturgeon migrates up the Sacramento and Feather Rivers, and probably the San Joaquin River, in the late winter and spring to spawn. Most spawning presently occurs in the Sacramento River between about Ord Bend and Knights Landing. The fertilized eggs sink to the bottom and adhere to rocks and gravel. Nursery areas for the young fish are in the lower Sacramento River, the Delta, and San Pablo Bay.

Populations of white sturgeon are considered unstable. The number of legal size (>40 inch) white sturgeon in the estuary has been estimated eight times

between 1954 and 1987, and has fluctuated widely between 11,200 in 1954 and 128,300 fish in 1984 (USFWS 1990a). Juvenile abundance appears closely tied with Delta outflows, with consistently poor year classes produced at or below about 22,000 cfs. Variations in recruitment of young-of-the-year fish appear to have a greater effect upon future adult populations, rather than variations in the annual survival rates of older age classes.

White catfish and channel catfish also comprise one of the most important sportfishing resources in the Sacramento River system. Catfish are resident species, mainly occupying areas with slower moving currents such as side channels, sloughs, and backwater areas. They occur along the entire reach of the Sacramento River up to Keswick Dam, and throughout the Delta. It is estimated that populations of catfish have been relatively stable for the last three decades (USFWS 1990a).

Other fish species, including largemouth bass, crappie, and other sunfishes are found throughout the project area. These species often use nearshore areas and river backwater areas and similar areas where current velocities are lower, and warmer water provides conditions more conducive to development of these fish. Many of these species can at times be found along vegetated shorelines of the river and associated sloughs where valuable cover is provided by overhanging and/or partially submerged shrubs or trees (i.e., SRA Cover).

Despite poor water quality and extreme flow fluctuations, the Colusa Drain supports many fish species. Fish found in the drain include white catfish, channel catfish, largemouth bass, bluegill, green sunfish, brown bullhead, and carp. Chinook salmon are not commonly found in the Drain, but do occasionally stray into the channel (Brian Finlayson, pers. comm.).

3. Wildlife

Diversity and abundance of wildlife within the project area have also been reduced substantially from historical levels. Agricultural development and other human modifications have resulted in a substantial loss of natural habitat. Species which were dependent of riparian, emergent marsh, and grassland habitats have declined accordingly.

Natural habitat in the project area is extremely fragmented and occurs in thin stands frequently bordered by public roadways. In areas upstream from the project area, the greater extent and diversity of habitat results in proportionately higher abundance and diversity of wildlife populations. Common mammals found within the project reaches include both cottontail and jack rabbits, gray squirrel, red and gray foxes, raccoon, opossum, mink, weasel, striped and spotted skunks, muskrat, beaver, and river otter.

Various avian species are common throughout the project area and include the California quail, ring-necked pheasant, mourning dove, mallard, wood duck, herons, egrets, various owls, hawks, and numerous species of passerines. Hawks include red-tailed, red-shouldered, and Swainson's; Swainson's hawks, a state-listed threatened species, are quite common nesters in certain reaches. This raptor is present in California in greatly reduced numbers from historical levels. The area of greatest density of the remaining population are riparian corridors in the central portion of the Central Valley, including the Sacramento River and tributaries, especially below Colusa.

While the above avian species can be found in terrestrial and aquatic habitats along the river, some bird species are dependent on the presence of eroding or vegetated banks along rivers and streams. In the project area this includes the bank swallow, rough-winged swallow, and the belted kingfisher.

Populations of the bank swallow, a state-listed threatened species, have been significantly reduced in the project area where extensive amounts of bank protection have virtually eliminated the type of eroding natural banks the swallow requires as nesting substrate. The remaining population stronghold of the bank swallow in California is the mainstem of the Sacramento River above Colusa, where most of the remaining suitable habitat exists; only a few areas below Colusa support the species.

Amphibians and reptiles are also found along the waterways in the project area. These species include gopher snakes, western rattlesnake, and several species of garter snake, western fence lizard, alligator lizard, Pacific tree frog, bullfrog, and the western pond turtle.

4. Threatened and Endangered Species

At least six Federally-listed species and one species proposed for listing may be found within Colusa and Yolo Counties, where proposed construction activities would occur. The discussions of the species which follow should be regarded as preliminary information, which we are providing to assist you in preparation of a Biological Assessment, should one be deemed necessary. A list of species which may occur within the larger Phase V study area is presented in Appendix B.

a. Plants
Palmate-bracted bird's-beak, *Cordylanthus palmatus*
Federal Status: Endangered
State: Endangered

Historically, the **palmate-bracted bird's-beak** was collected from seven localities in Alameda, Fresno, Madera, San Joaquin, Yolo, and Colusa counties. Impacts could result from direct physical destruction of the plant or degradation of habitat during construction activities. This plant occurs mainly on relatively undisturbed, seasonally-flooded, saline-alkaline soils in alkali sink habitat. It is associated with halophytes such as alkali heath (*Frankenia grandiflora* ssp. *campestris*), alkali weed (*Cressa truxillensis* ssp. *vallicola*), pickleweed (*Salicornia* sp.), seepweed (*Suaeda* sp.), iodine bush (*Allenrolfea occidentalis*), and some species of saltbush (*Atriplex* sp.). Palmate-bracted bird's-beak blooms from May through October.

b. Invertebrates
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*
Federal Status: Threatened
State Status: none

The valley elderberry longhorn beetle (VELB) is found only in association with its host plant, elderberry (*Sambucus* sp.), which the beetle requires to complete its life cycle. Adults feed on the foliage and perhaps flowers, and are present from March through early June. In the spring the beetles mate, and the females lay eggs on living elderberry plants. After transforming into an adult within the plant stems (they typically are found in stems greater than one inch in diameter), the beetle chews an exit hole and emerges from the elderberry plant. Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, but most often in riparian or savanna areas (USFWS 1991b).

VELB populations are known to occur along River Miles 80-90, 126, 139, 170, 178 and 179 (USFWS 1990b). There are undoubtedly other areas which have extant populations of beetles within elderberry plants. Adverse impacts to the beetle could occur if construction activities disturbed any of the plants.

c. Fish
Winter-run chinook salmon, *Oncorhynchus tshawytscha*
Federal Status: Endangered
State Status: Endangered

The winter-run chinook salmon is a unique population of chinook salmon that spawns in the Sacramento River and is distinguishable from other chinook salmon runs found in the river based on the timing of its upstream migration and spawning season. Modification and loss of spawning and rearing habitat are thought to be major factors contributing to the decline of the winter-run chinook salmon. Currently, about 95% of winter-run chinook salmon spawning occurs between Keswick Dam and Red Bluff Diversion Dam; the remainder occurs downstream of Red Bluff Diversion Dam (NMFS 1992). Since water impacts have been deleted, winter-run chinook salmon likely will not be affected by project alternatives.

Delta smelt, *Hypomesus transpacificus*
Federal Status: Threatened
State status: Threatened

The delta smelt, a slender-bodied translucent planktivorous fish, is the only true native estuarine fish in the San Francisco Bay Estuary (Moyle *et al.* 1992). The delta smelt typically has a 1-year life span. Adults enter dead-end sloughs and channel edge-waters of the Delta to spawn between about February and June. Spawning occurs in open waters, and the adhesive, demersal eggs attach to hard substrates such as rocks, tree roots, gravel, and submerged branches and vegetation. Fecundity is low, usually ranging between 1,400 and 2,800 eggs per female. Adults typically die after spawning. Eggs hatch in 10-14 days, and the planktonic larvae and juveniles are transported downstream to the estuarine mixing zone that, depending on outflow, may be located from Suisun Bay to the confluence of the Sacramento and San Joaquin Rivers. Juveniles feed on zooplankton.

Although the delta smelt was one of the most common fish in the Delta as recently as the 1970s, it has undergone roughly a ten-fold decline in the past 10 years (from several million to several hundred thousand). Consequently, in 1993 the smelt was listed as threatened under the Federal Endangered Species Act. The primary factors which have contributed to the decline in the delta smelt population include freshwater exports from the Sacramento River and agricultural and urban water diversions from the San Joaquin River, resulting in changes in Delta hydrology. Other factors contributing to the smelt's decline include several consecutive years of drought, introduction of nonindigenous aquatic species leading to increased competition for food sources, and reductions in abundance of key food sources. The project as described is not likely to adversely affect this species, as it likely does not occur in the project impact areas.

d. Reptiles
giant garter snake, *Thamnophis gigas*
Federal Status: Threatened
State Status: Threatened

The giant garter snake inhabits sloughs, ponds, small lakes, low gradient streams and other waterways, such as irrigation and drainage canals. It feeds primarily on small fishes and frogs. Some of the habitat requisites for this snake consist of adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover, and emergent, herbaceous wetland vegetation such as cattails and bulrushes, for escape cover and foraging

habitat. The giant garter snake inhabits small mammal burrows throughout its winter dormancy period (November to mid-March). The breeding season extends through March and April, and females give birth to live young from late July through early September. Clutch size is variable, ranging from 10 to 46 young. Urban expansion, flood control projects, and other human activities currently threaten the survival of this snake throughout its range (USFWS 1991). Suitable habitat for this species is found in the project area, particularly in the drainage ditches. Depending upon the construction techniques selected, the species may be affected by the project.

e. Birds
bald eagle, *Haliaeetus leucocephalus*
Federal Status: Endangered
State status: Endangered

Bald eagles are known to migrate through and winter in many parts of California. They also breed locally in California, including along several tributary streams in the San Joaquin-Sacramento River system. They occur sparsely in most regions, but aggregations occur regularly in certain areas, typically near bodies of water. Bald eagles feed mainly on fish, and by scavenging waterfowl and mammals. They generally require lakes, reservoirs, or free-flowing rivers with abundant fish; they perch on large, stoutly limbed trees, snags or broken-topped trees, or rocks near the water. This species breeds from February through July, with peak activity March to June, and 87 percent of nest sites located within 1 mile of water. Monogamous, bald eagles breed first at year 4 or 5, with an average clutch size of 2 eggs (Zeiner *et al.* 1990).

Populations of bald eagles have become seriously diminished in number due to shooting, pesticides and human encroachment. Artificial reservoirs have become important wintering areas in the state. Eagles are occasionally seen using large trees and snags in riparian forests surrounding the upper Sacramento River for roosting habitat during the fall and winter. One breeding pair has a territory between Chico Landing and Red Bluff. Disturbance by construction or other human activities may cause eagles to abandon their territories or roosting sites.

f. Proposed Species
Sacramento splittail, *Pogonichthys macrolepidotus*
Federal Status: Proposed Threatened
State: Special Concern

The Sacramento splittail is a large (up to 40 cm) minnow endemic to California's Central Valley. The species has been restricted to a small portion of its former range (USFWS 1994) and is now found primarily in the Sacramento River and Sacramento-San Joaquin Delta, Suisun Bay, Suisun Marsh, and Napa Marsh.

Splittail are primarily freshwater fish, but are tolerant of moderate salinities. They require flooded vegetation for spawning and as foraging areas for young. Spawning season seems to be associated with increasing water temperature and day length and occurs in late April and May in marsh habitats; and in tidal freshwater habitats spawning occurs by late January/early February and continues through July. Larvae remain in the shallow, weedy areas inshore in close proximity to the spawning sites and move into the deeper offshore habitat later in the summer. Splittail have disappeared from much of their native range because dams, diversions and agricultural development have eliminated or drastically altered much of the lowland habitat

these fish once occupied (USFWS 1994). Since water impacts have been deleted, Sacramento splittail likely will not be affected by project alternatives.

g. Candidate Species

The following candidate species (those species in which Federal listing is pending) may also be found in the project area:

Plants
California hibiscus (*Hibiscus californicus*)

Amphibians
California tiger salamander (*Ambystoma tigrinum californiense*)
California red-legged frog (*Rana aurora draytoni*)

Birds
ferruginous hawk (*Buteo regalis*) (winter resident)
white-faced ibis (*Plegadis chihi*)
tri-colored blackbird (*Agelaius tricolor*)

Mammals
San Joaquin pocket mouse (*Perognathus inornatus*)
San Joaquin woodrat (*Neotoma fuscipes riparia*)

h. State-Listed Species

The following state-listed species may be found in the project area. A formal list should be obtained from the California Department of Fish and Game.

Plants
Palmate-bracted bird's beak (E)

Reptiles
giant garter snake (T)

Birds
willow flycatcher (E)
yellow-billed cuckoo (E)
bank swallow (T)
Swainson's hawk (T)

VI. IMPACT ASSESSMENT

A. METHODOLOGY

Habitat types in the project area were delineated on 1: 2,800 (1" = 400') scale blueline copies of aerial photographs. Preliminary estimates of direct construction impacts were made by delineating the boundaries of the permanent and temporary construction easements onto the habitat maps, and calculating the affected acreage.

B. RESULTS

This section includes a discussion of the direct impacts expected to occur at each construction site due to implementation of the various alternatives. The estimated impact acreage for each alternative at each site is summarized in

Table 1. Overall, there would be some degree of impact to fish and wildlife sustained with any of the construction actions. Impacts of some construction activities would be minimal, depending on the construction alternative selected and the existing fish and wildlife habitat values present at the work site. Minimal impacts would likely require little to no mitigation other than reseeding of affected areas with grasses, and careful scheduling of work.

However, other construction activities, depending on the site, would cause significant adverse impacts and require substantial replacement mitigation. The impacts anticipated from the proposed construction methods and alternative designs at each site are described below.

Table 1. Projected habitat losses, by construction site, Sacramento River Flood Control System Evaluation, Phase V.

SITE *Habitat Type*	Construction Impacts (Acres)	Estimated Compensation Ratio	Estimated Mitigation Needs (acres/ linear feet)	Approximate Mitigation Costs
Site A				
Freshwater emergent marsh	2.90	1.5:1	4.35	$21,750
Rice field	27.00	1.5:1	40.50	Unknown
Site B				
Freshwater emergent marsh	2.70	1.5:1	4.05	$20,250
Rice field	27.00	1.5:1	40.50	Unknown
Site C				
No habitat impacted	---	---	---	Unknown
Site D				
Riparian woodland	0.75	3:1	2.25	$56,000
Site E				
Riparian woodland	6.57	3:1	19.71	$492,750
Orchard	9.50	1.5:1	14.25	Unknown
Individual trees	11 trees	5:1	55 trees	Unknown

1. General

Loss of riparian vegetation along the Sacramento River or Colusa Drain would adversely affect and wildlife in the project area. The loss of riparian habitat could be especially detrimental in the project area, where riparian vegetation has already been reduced to a thin strand along the river. In the past, some levee construction activities have simply removed all riparian vegetation at a construction site. The result of this has been the complete denuding of extensive areas of the Sacramento River. This, in turn, has caused the loss of valuable wildlife movement and migration corridors, and the fragmentation of remaining habitat. As these impacts occur, the viability of existing wildlife populations are further reduced, leading to severe population losses in those species that require extensive or contiguous areas of habitat.

Construction alternatives proposed at all of the sites involve disturbance of vegetation on the landside of project levees. The project has recently been revised so that no waterside impact would occur. Loss of riparian habitat would adversely affect wildlife species found in the riparian corridor along the Sacramento River. Riparian woodland supports a large and diverse array of wildlife species along the Sacramento River and, to a lesser extent, along the

Colusa Drain. The high diversity of tree growth, cover conditions and layers, and close proximity to water provide a wide variety of easily accessible habitats and niches. Any loss of plant diversity would adversely affect those wildlife species inhabiting the area.

Any loss of riparian habitats would have a significant adverse impact upon songbirds and small mammals that use these areas to meet all or part of their life requisites. Cover, nesting, and other reproductive habitats, food sources, and a portion of the migration corridor for songbirds and small mammals would be eliminated. In addition, all reptiles and amphibians which depend on this interface of terrestrial and aquatic habitats to meet their life needs would be adversely affected.

Construction activities, and any disturbance or loss of riparian vegetation would likely adversely affect nesting raptors, including the Swainson's hawk, at the Sacramento River sites and possibly the Colusa Drain sites. Loss or disturbance of nesting habitat could severely impact populations of these species.

Elimination of freshwater emergent wetlands would reduce the amount of available habitat for wading birds such as herons and egrets, waterfowl such as mallard ducks and pied-billed grebe, and various species of amphibians and reptiles. However, impacts would be greatly minimized if replacement habitat were to be created *prior to* elimination of existing habitat, as proposed. This would allow organisms to colonize the newly created habitat, resulting in minimal losses in abundance of these species. However, great caution should be used in relocating such ditches because many species, including the giant garter snake, may be impacted by construction activities.

The impact on grassland and forbs on the levee slopes would be minimal and temporary. Disturbance or loss of this habitat would adversely impact some raptors, small mammals, and other ground-dwelling species. This impact would be temporary, however, as grasses and forbs would reestablish within a few fish years and thus regain habitat values similar to the pre-construction condition.

Losses of rice fields would adversely affect wading birds, sandhill cranes, and wintering waterfowl, including ducks and geese, that use these areas for foraging during fall and winter. In areas where orchards occur adjacent to construction sites, the loss of fruit and nut trees would adversely impact perching birds. Also, construction activity during raptor nesting periods could lead to the failure of nesting success.

A significant amount of borrow material would be required to raise and reinforce the levees. The impacts on vegetation and wildlife at the borrow sites are anticipated to be minimal, as existing habitat at the borrow sites is largely disturbed and therefore of low habitat value. More detailed surveys of the borrow areas should be conducted during the HEP analysis in the later stages of the planning process, as cover type determinations at these sites for this analysis was based on rough interpretations of aerial photographs.

2. Specific Impacts

This section describes the impacts that would occur at each construction site, and ways these impacts could be avoided or minimized. Table 1 shows the impact acreages, approximate compensation ratios, and mitigation requirements for the currently-proposed actions. Compensation ratios were estimated from the Service's previous HEP evaluations on similar habitat types in the Sacramento Valley. Actual compensation ratios would be determined by the

Service in their HEP evaluation associated with this project. Such an evaluation would be included in a FWCA report for the project.

a. Site A
Landside construction would impact 2.9 acres of freshwater emergent marsh habitat and 27.0 acres of rice fields. According to project information, drainage ditches would be reconstructed as part of the project. Because drainage ditches would be replaced prior to construction, net impacts to marsh habitat would be minimal. However, loss of rice fields would be significant, as this habitat provides important forage for wintering waterfowl species.

If replacement ditches are reconstructed prior to impact to the existing ditches, adverse impacts to emergent marsh would likely be self-mitigating. However, additional mitigation may be necessary for impacts to the giant garter snake; this would be determined based on consultation with the Service's Endangered Species Office. If the ditches would be replaced concurrently with or subsequent to impact, mitigation of emergent marsh habitat, at a ratio of about 1.5:1, would be needed as compensation.

b. Site B
Project construction at this site would result in the initial removal of 2.7 acres of freshwater emergent marsh and 27 acres of rice fields. All work would be conducted landside of project levees; therefore, no aquatic impacts are expected to be incurred in the Colusa Drain. No other alternative construction techniques are proposed for this site.

c. Site C
Adverse impacts at Site C resulting from restoration of the levee crown is expected to be minimal, as existing habitat quality at the site is low. If construction proceeds as described, no mitigation should be necessary. Any impacts to annual grassland habitat, should they occur, should be compensated by reseeding of affected areas.

d. Site D
Impacts to wildlife habitat at Site D would consist of the elimination of about 0.75 acres of riparian woodland through berm construction on the landside of the levee. Annual grassland would also be impacted. Most of the woodland vegetation that would be impacted consists of single valley oak trees and elderberry. Selection of the cutoff wall alternative would likely reduce the above riparian impacts to an insignificant level.

e. Site E
Habitat losses at this site include the elimination of 6.57 acres of riparian woodland, 9.5 acres of orchard, and 11 trees. All impacts would occur to vegetation found landside of the existing levee. Selection of the cutoff wall alternative would likely reduce the riparian impacts to an insignificant level.

VII. DISCUSSION

A. MITIGATION PLANNING GOALS

The recommendations provided herein for mitigation and the protection of fish and wildlife are in conformance with the Fish and Wildlife Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981). The Mitigation Policy provides Service personnel with guidance in making recommendations to protect, conserve, and enhance fish and wildlife and their habitats. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service

recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of important and valuable fish and wildlife resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife habitat values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife.

In applying the Mitigation Policy during an impact assessment, each specific habitat or cover-type that may be impacted by the project is identified. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category determination. Selection of evaluation species can be based on several rationales, including: (1) species known to be sensitive to specific land and water use actions, (2) species that play a key role in nutrient cycling or energy flow, (3) species that utilize a common environmental resource, or (4) species that are associated with important resource problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Fish and Wildlife Service. Evaluation species used for Resource Category determinations may or may not be the same evaluation elements used in an application of the Service's Habitat Evaluation Procedures (HEP). Finally, based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation goals range from "no loss of existing habitat value" (Resource Category 1) to "minimize loss of habitat value" (Resource Category 4). The goal for Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses of habitat value would need to be replaced in-kind. As defined in the Fish and Wildlife Service's Mitigation Policy, "in-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

Under Pacific Region Fish and Wildlife Service guidance, we are also pursuing a goal of no net loss of wetland acreage, while seeking a net overall gain in the quality and quantity of wetlands through restoration, development and enhancement. Furthermore, the Service believes that wetlands compensation, which is the creation of wetlands to offset losses, should only be deemed acceptable when losses are determined to be unavoidable and compensation is known or believed to be technically feasible. Restoration of former or degraded wetlands is the preferred form of compensatory mitigation, followed by wetlands creation. However, accordant with Regional wetlands policy, either of these methods must result in no net loss of wetland acreage. These general goals regarding wetlands are used in the Service's analyses and recommendations relative to all proposed projects.

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectification, reduction or elimination of impacts over time, and compensation.

Impacts to four habitat types were evaluated for this analysis. These habitats, and their corresponding evaluation species, designated Resource

Categories and associated mitigation planning goals are discussed below, and summarized in Table 1.

1. Riparian Woodland

Riparian woodland occurs along the Sacramento River, and intermittently along the Colusa Drain. Riparian habitats, including those in the project area, are of high value to a wide array of wildlife species. Riparian habitat provides resting areas, and nesting and feeding perches for raptors such as red-shouldered and Swainson's hawks and passerine birds such as northern oriole and yellow warbler as well as a multitude of other fish and wildlife species. We have selected these animals as evaluation species because (1) they play key roles in the community ecology of the study area; (2) the Service has responsibility for the management of these species under the Migratory Bird Treaty Act; and (3) they provide important human non-consumptive benefits. Riparian woodland habitat is scarce in the project area and ecoregion (San Joaquin Valley), having experienced severe declines in acreage and extent on a local and regional basis.

The Service's mitigation planning goal for riparian woodland is for "no net loss of in-kind habitat value or acreage" (Resource Category 2). This planning goal is based on the scarcity of these habitat types in the project area and ecoregion and their high value to the evaluation species. This mitigation goal necessitates the development of compensation plans designed to achieve no overall net loss of in-kind habitat value or acreage for each of these habitat types. In addition, our regional planning goal for wetlands, including riparian habitat, is for "no net loss of wetlands acreage or value, whichever is greater".

2. Freshwater Emergent Marsh

In the project area freshwater emergent wetlands occur in drainages adjacent to the Colusa Drain. Emergent wetlands of the project vicinity are characterized by non-woody emergent vegetation, predominantly cattails, rushes (*Juncus* sp.), and sedges (*Cyperus* sp.). Two marsh-nesting passerine birds--the marsh wren and red-winged blackbird--and two wading birds--the great blue heron and great egret were chosen to evaluate emergent wetland. The marsh wren (*Cistothorus palustris*) and red-winged blackbird (*Agelaius phoenicus*) are passerine species which nest and feed in emergent wetlands, and could therefore be present in any occurrences of this cover type which may be found in the project area. Great blue herons (*Ardea herodias*) and great egrets (*Casmerodius albus*) forage extensively in wetlands on aquatic vertebrates; these wading birds are a highly visible species, which many people take great pleasure in observing. All of the evaluation species are also migratory birds for which the Service has management responsibility under the Migratory Bird Act. In the project vicinity, and the ecoregion (Central Valley) in general, emergent wetlands are relatively scarce, and are of high value to the evaluation species. Thus, emergent wetlands in the project impact area should also have a mitigation planning goal of "no net loss of in-kind acreage or habitat values, whichever is greater" (Resource Category 2).

3. Annual Grassland

Annual grasslands are fairly common along project levees and channels. Grasslands in the area and in California were once dominated by native perennial and annual grass species, but these have been largely displaced by introduced annual grasses. Grassland areas provide habitat for granivorous birds such as western meadowlarks (*Sturnella neglecta*), California quail (*Callipepla californica*), and sparrows and finches, and for California voles (*Microtus californicus*) and pocket gophers (*Thomomys* sp.). These areas also provide important foraging habitat for a number of raptors such as red-tailed hawks, Swainson's hawks, American kestrels, and burrowing owls.

Evaluation species selected for resource category designation of this habitat are raptors and ground-foraging birds. These species were chosen because: (1) raptors, as predators, play a key role in the community ecology of the area; (2) they offer important human nonconsumptive benefits; and (3) the Service has responsibility for these species under the Migratory Bird Treaty Act. Annual grasslands are of medium to high value to the evaluation species, and is relatively abundant in the project area. Therefore, our mitigation planning goal is for "no net loss of habitat value while minimizing loss of in-kind habitat value" (i.e., Resource Category 3).

4. Agricultural Land

Rice crops and orchards in the project area provide suitable habitat for raptors, mourning doves, pheasants, and other avian wildlife. In the winter, waste grains provide important forage material for a variety of waterfowl species including sandhill cranes and several species of ducks and geese; these crops also provide feeding habitat for resident species such as great egrets and great blue herons. Evaluation species selected to evaluate these agricultural crops include waterfowl, wading birds, and mourning dove. These crops are of medium to high value to the evaluation species, and are relatively abundant in the project area. Therefore, our mitigation planning goal is for "no net loss of habitat value while minimizing loss of in-kind habitat value" (i.e., Resource Category 3).

B. MITIGATION

Since this is a reconnaissance level report, only minor field work was conducted to quantify the impact on the habitats that would be affected if the project were to proceed to construction. It is possible to provide an estimate of the impacts and compensation needs using the mitigation goals established in the Service mitigation policy and past experience with similar projects. These estimates should be considered very preliminary estimates of compensation needs. Compensatory mitigation in a feasibility-level study would be recommended after other methods, including avoiding or minimizing the impacts, have been fully considered. The Service would conduct a HEP analysis to determine compensatory mitigation needs, should this project proceed to the feasibility level.

Following is an estimate of impacts, compensation needs, and costs for the project. These are summarized in Table 1. To compensate adverse impacts to a total of 7.32 acres of riparian woodland in the project area, about 21.96 acres (3:1 replacement ratio) would need to be replanted to offset habitat losses. Plantings of native woody riparian species (trees and shrubs) would be required in the area to replace lost habitat values. Estimated costs to replace riparian vegetation typically amount to $25,000 per acre, excluding land acquisition, resulting in a total of $549,000 revegetation costs. Irrigation (drip system) would be needed for a minimum of at least 3 years, or until the plantings are well established and self-sustaining. Any dead or deteriorating plantings would be replaced and maintained until well established. A detailed monitoring study should be conducted for a period of 10 years to determine the success of the plantings.

The 11 trees that would be removed due to construction along the landside levee toe and adjacent areas should be replaced at a ratio of at least five-to-one, for a total replacement need of 55 trees. All plantings would require watering and maintenance until it is demonstrated that they are self sustaining. Drip irrigation would be an efficient watering method. The cost of this plan is unknown.

To offset the adverse impacts to 5.6 acres of freshwater emergent marsh, an estimated 8.4 acres on site would need to be created, based on a replacement ratio of 1.5:1. Total revegetation costs would be about $42,000 (8.4 acres x $5,000).

Annual grassland areas disturbed by construction activities should be reseeded with various grasses and forbs, native species if possible. Grasses and forbs should be seeded at a rate appropriate for species and conditions, but generally not less than 30 pounds of seed per acre. Areas to be seeded should be disced and sown in early fall, as soon after construction as possible, to promote germination and establishment during the ensuing rainy season. The cost of such grassland seeding is estimated at $800-1,000 per acre. We estimated that post-construction reseeding of grasses on the construction areas, including levee slopes, would offset project impacts to grasslands, resulting in no overall loss of this habitat type.

Agricultural land replacement ratios are likely to be about 1.5:1. Therefore, mitigation for elimination of 54 acres of rice fields would amount to in-kind revegetation of 81 acres; losses of 9.5 acres of orchard lands could be mitigated by in-kind creation of 14.3 acres. These habitats could also be replaced out-of-kind with higher value habitats, which would likely result in lower compensation ratios. The costs of this plan are currently not known.

The wetland values associated with rice fields could be offset through establishment of emergent marsh. Emergent marsh could be established within the irrigation ditches which would be replaced. These ditches could be widened to accommodate this added vegetation. Replacement ratio of this plan would be about 1:1.

RECOMMENDATIONS

The Service recommends the following:

1. To mitigate any adverse impacts of the proposed alternatives on riparian vegetation, wetland vegetation, grassland, and landside trees and shrubs, measures as indicated in the Mitigation Section of this report be implemented. Final impact determination and mitigation requirements will be conducted through the use of the Service's Habitat Evaluation Procedures.

2. Survey construction sites during the spring and summer prior to construction to determine whether Swainson's hawks are nesting in the project area.

3. To avoid potential construction activity impacts to Swainson's hawk and other raptors, construction not be conducted within a half-mile radius of active Swainson's hawk nests from March 15 to September 1, or until a determination has been made by a Department wildlife biologist that the young have successfully fledged and are no longer vulnerable to disturbance, or that the reproductive attempt has failed.

4. If toe drains are constructed, open toe drains should be used in lieu of culverts to minimize vegetation losses. Toe drains should be designed to allow growth of wetland and other vegetation in and adjacent to the drain. Also, as a possible enhancement measure, depressions could be excavated in adjacent farmlands and drain water could be directed to these areas. This would promote the growth of wetland and other vegetation.

5. After completion of repair work, construction areas (non-mitigation sites) should be reseeded with native grasses to restore wildlife habitat and overall environmental quality.

6. Population surveys be done for species protected under the State's Endangered Species Act, such as the Swainson's hawk and bank swallow. Where potential habitat exists, appropriate surveys should be conducted for all potential species.

7. The following recommendations are provided pursuant to Section 7 of the Endangered Species Act.

   a. Determine potential effects of the project on listed or proposed species or critical habitat, by conducting surveys for the species of potential habitat, as appropriate.

   b. Should the species or critical habitat be present, complete a Biological Assessment for the project and determine whether the species would be affected.

   c. To reduce the likelihood of the species being adversely affected by the project, add any recommendations for project modifications which would reduce or eliminate the effects.

   d. Should the proposed action be likely to affect the species of its critical habitat, initiate formal consultation with the Service.

LITERATURE CITED

Bellrose, F.C. 1976. Ducks, geese, and swans in North America. Stackpole Books. 540 pp.

California Department of Fish and Game. 1988. Sacramento River Riparian Atlas - Verona to Redding. Prepared for the Wildlife Conservation Board by the Nongame Heritage Program.

California Department of Water Resources. 1966. Sacramento Valley East Side Investigation - A Study of Surface Water Development Opportunities in Eastern Tehama and Western Butte Counties. Bulletin 137, Appendix C, Fish and Wildlife, June, 1966. By California Department of Fish and Game, Water Projects Branch, Contract Services Section. 89 pp.

California State Reclamation Board. 1988. Interim Guide for Vegetation on Flood Control Levees Under Reclamation Board Authority. September.

California State Resources Agency. 1989. Upper Sacramento River Fishes and Riparian Habitat Management Plan.

DeHaven, R.W. 1989. Value, scarcity, uniqueness and replaceability of shaded riverine aquatic cover of selected reaches of the Sacramento River system, Sacramento Valley, California. USFWS Report, Sacramento Field Office. 11 pp.

Dileanis, P.D., S.K. Sorenson, S.E. Schwarzbach and T.C. Maurer. 1992. Water quality, bottom sediment, and biota associated with irrigation drainage, Sacramento Refuge Complex, California. USGS Water-Resources Investigations Report 92-4036.

Hallock, Richard J. 1987. Sacramento River System Salmon and Steelhead Problems and Enhancement Opportunities. A Report to the California Advisory Committee on Salmon and Steelhead Trout. 92 pp.

Jones and Stokes Associates. 1987. Final Environmental Impact Report and Supplemental Environmental Impact Statement IV. Sacramento River Bank Protection Project. Prepared for the Reclamation Board, State of California, and the US Army Engineer District, Sacramento, CA.

Kjelson, Marty, et al. 1982. The Life History of Fall-run Juvenile Chinook Salmon (Onchorhynchus tshawytscha) in the Sacramento - San Joaquin Estuary of California. California Department of Fish and Game Report.

Michny, Frank and Deibel, Robert. 1986. Sacramento River Chico Landing to Red Bluff Project, 1985 Juvenile Salmon Study. USDI, Fish and Wildlife Service, Sacramento, CA. Prepared for the US Army Corps of Engineers, Sacramento, CA.

Moyle, Peter M. 1976. Inland Fishes of California. University of California Press, Berkeley, CA.

Moyle, P.B., B. Herbold, D.E. Stevens, and L.W. Miller. 1992. Life History and status of the delta smelt in the Sacramento-san Joaquin Estuary, California. Transactions of the American Fisheries Society 121:67-77.

National Marine Fisheries Service. 1992. Federal Register, Vol. 57, No. 158. Designated Critical Habitat: Sacramento River Winter-Run Chinook Salmon. 7pp.

Pacific Fishery Management Council. 1990. Review of 1989 Ocean Salmon Fisheries. 100 pp.

San Joaquin Valley Drainage Program. 1990. Fish and wildlife resources and agricultural drainage in the San Joaquin Valley, California: Volume 1.

U.S. Department of Agriculture. 1979. Wetland Vegetation Survey, Colusa Basin - Butte Sink. Soil Conservation Service. 5 pp. plus appendices.

U.S. Fish and Wildlife Service. 1976. Fish and Wildlife Management Plan for the Sacramento River Bank Protection Project, California. USDI, Fish and Wildlife Service, Portland, OR. 44 pp. plus appendices.

_____. 1987. Middle Sacramento River Refuge Feasibility Study. 47 pp. plus appendices.

_____. 1990a. Planning Aid Letter--Sacramento River Flood Control System Evaluation, Phase V. Sacramento Field Office. 21 pp.

_____. 1990b. Endangered Species Technical Bulletin. Vol. XV, No. 8.

_____. 1991a. *The Distribution, Habitat, and Status of the Valley Elderberry Longhorn Beetle*. FWE Field Office, Sacramento, CA.

_____. 1991b. *Federal Register, Vol. 56, No. 249. Proposed Endangered Status for the Giant Garter Snake*. FWE Field Office, Sacramento, CA. 7 pp.

_____. 1994. Federal Register, Vol. 59, No. 4. Proposed Rule: Determination of threatened status for the Sacramento Splittail. 7 pp.

U.S. Geological Survey. 1988. Water Resources Data, California. Volume 4. Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line.

Zeiner, D.C., Laudenslayer, W.F. Jr., Mayer, K.E., White, M., *ed.*, 1990. *California's Wildlife;* California Statewide Wildlife Habitat Relationships System, California Department of Fish and Game. Sacramento, CA. 1138 pp.

C—104024

C-104024

PERSONAL COMMUNICATION

Brandes, Patricia. 1994. Senior Staff Biologist, Fish and Wildlife Service, Sacramento/San Joaquin Estuary Fishery Resource Office, Stockton, CA.

Finlayson, Brian. 1994. Biologist. California Department of Fish and Game.

Hamelberg, Scott. 1994. Fishery Biologist, Fish and Wildlife Service, Northern Central Valley Fishery Resource Office.

C-104025

C-104025

LIST OF APPENDICES

C—104026

C-104026

APPENDIX A
U.S. ARMY CORPS OF ENGINEERS'
PROJECT DESCRIPTION
SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION
PHASE V

C—104027

C-104027

UPPER SACRAMENTO AREA, PHASE V, PROPOSED RECONSTRUCTION SITES
12 January 1995

SITE A
STABILITY BERM/RELOCATE DITCH, Colusa Basin Drain, 15,500 LF of landside stability berm and ditch relocation; levee crown restoration, and lime treatment.

Proposed work consists of cutting and reshaping the existing landside slope, building a landside stability berm (15 feet from the top of the levee crown with 2 to 8 feet of height and 20 feet wide), restoring the levee crown in two areas (2,100 LF and 1,200 LF), and relocating a large irrigation ditch 50 feet from the existing levee toe. The first 8,000 LF of levee crown and landside levee slope eastward of Road 99A will be restored by a lime treatment. The lime treatment consists of adding 4% by weight lime and mixing to a depth of 2 to 3 feet on the landside slope and crown with any organic matter being removed.

An alternative to the stability berm/ditch relocation may include reshaping the landside levee slope and not relocating the ditch. Additional study and design modifications will be necessary in the Design Memorandum and Plans and Specifications.

SITE B
STABILITY BERM/RELOCATE DITCH, Colusa Basin Drain, 29,000 LF.

Proposed work consists of cutting and reshaping the landside slope, building 29,000 LF of landside stability berm, restoring the levee crown (3,200 LF), and relocating a large irrigation ditch 50 feet from the existing levee toe (same as site A).

Alternatives would consist of varying the landside berm and slope as well as the ditch relocation to preserve habitat as much as possible. These alternatives would be extensively reviewed in the Design Memorandum and Plans and Specifications.

SITE C
LEVEE CROWN RESTORATION, Sacramento River Mile 101.80R-102.05R, 1,500 LF.

Proposed work consists of adding 2 to 3 feet of embankment material on top of the existing levee centerline on the road west of the bins and filling existing depressions on the top of the levee.

SITE D
SEEPAGE/STABILITY BERM, Sacramento River Mile 119.1R-119.6R, 2,700 LF.

Proposed reconstruction consists of adding a landside seepage/stability berm (20 feet wide at the top to be located about 1/3 from the base of the existing levee toe with gravel or rock in the base of the constructed berm to control seepage

(prevent the movement of levee soil).

Alternative design could be a cutoff bentonite-cement slurry wall down the centerline of the levee, but this design is probably more expensive and requires closure of the county road. A likely alternative to save the trees on the west end of the site is to bury part of the tree trunks or to taper in the berm width to avoid these large trees. These alternatives will be looked at in the future.

SITE E

SEEPAGE/STABILITY BERM/POSSIBLE CUTOFF WALL, Sacramento River Mile 140.0R-143.17R, 16,700 LF,

The alternative design for Site E is the same as Site D. Design includes no work in areas of ramps or limited/no work in close proximity of existing farm and residential buildings. It is likely that the cutoff wall could be done in front of several existing farm and residential buildings to avoid impacts to existing structures and trees.

Alternatives include a cutoff bentonite-cement slurry wall along the entire 16,700 LF, however this alternative may not be cost effective.

APPENDIX B
THREATENED AND ENDANGERED SPECIES INFORMATION

C-104030

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OR MAY BE AFFECTED BY THE PROPOSED SACRAMENTO RIVER FLOOD CONTROL SYSTEMS EVALUATION PROJECT, PHASE V, KNIGHTS LANDING TO TISDALE BYPASS, TEHAMA, BUTTE, GLENN, SUTTER, COLUSA and YOLO COUNTIES, CALIFORNIA
(1-1-94-SP-1393, AUGUST 3, 1994)

Listed Species

Fish
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
delta smelt, *Hypomesus transpacificus* (T)

Reptiles
giant garter snake, *Thamnophis gigas* (T)

Birds
bald eagle, *Haliaeetus leucocephalus* (E)
Aleutian Canada goose, *Branta canadensis leucopareia* (T)

Invertebrates
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

Plants
palmate-bracted bird's-beak, *Cordylanthus palmatus* (E)
Contra Costa wallflower, *Erysimum capitatum* ssp. *angustatum* (E)
Butte County (Shippee) meadowfoam, *Limnanthes floccosa* ssp. *californica*(E)
Antioch Dunes evening-primrose, *Oenothera deltoides* ssp. *howellii* (E)

Proposed Species

Fish
Sacramento splittail, *Pogonichthys macrolepidotus* (PT)

Amphibians
California red-legged frog, *Rana aurora draytonii* (PE)

Plants
Stebbins' morning-glory, *Calystegia stebbinsii* (PE)
Pine Hill ceanothus, *Ceanothus roderickii* (PE)
Hoover's spurge, *Chamaesyce hooveri* (PT)
Pine Hill flannelbush, *Fremontodendron californicum* ssp. *decumbens* (PE)
El Dorado bedstraw, *Galium californicum* ssp. *sierrae* (PE)
Colusa grass, *Neostapfia colusana* (PT)
pilose Orcutt grass, *Orcuttia pilosa* (PE)
slender Orcutt grass, *Orcuttia tenuis* (PT)
Hartweg's golden sunburst, *Pseudobahia bahiifolia* (PE)
Layne's butterweed, *Senecio layneae* (PT)
Greene's tuctoria, *Tuctoria greenei* (PE)

Candidate Species

Fish

green sturgeon, *Acipenser medirostris* (2R)
longfin smelt, *Spirinchus thaleichthys* (2)

Amphibians

western spadefoot toad, *Scaphiopus hammondi hammondi* (2R)
foothill yellow-legged frog, *Rana boylii* (2)

Reptiles

California tiger salamander, *Ambystoma californiense* (1)
northwestern pond turtle, *Clemmys marmorata marmorata* (2)
southwestern pond turtle, *Clemmys marmorata pallida* (2)

Birds

tricolored blackbird, *Agelaius tricolor* (2)
loggerhead shrike, *Lanius ludovicianus* (2)

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)
greater western mastiff-bat, *Eumops perotis californicus* (2)
San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (2)
San Joaquin Valley woodrat, *Neotoma fuscipes riparia* (2)
spotted bat, *Euderma maculatum* (2)
Marysville Heerman's kangaroo rat, *Dipodomys californicus (=heermanni) eximus* (2)

Invertebrates

Sacramento Valley tiger beetle, (*Cicindela hirticollis abrupta*) (2R)

Plants

Suisun Marsh aster, *Aster lentus* (2)
Ferris's milk-vetch, *Astragalus tener* var. *ferrisiae* (2)
alkali milk-vetch, *Astragalus tener* var. *tener* (2R)
heartscale, *Atriplex cordulata* (2)
brittlescale, *Atriplex depressa* (2R)
big tarplant, *Blepharizonia plumosa* ssp. *plumosa* (2R)
Fremont's rosinweed, *Calycadenia fremontii* (2)
Butte County morning-glory, *Calystegia atriplicifolia* ssp. *buttensis* (2)
Red Hills soaproot, *Chlorogalum grandiflorum* (2)
Mosquin's clarkia, *Clarkia mosquinii* ssp. *mosquinii* (2)
Enterprise clarkia, *Clarkia mosquinii* ssp. *xerophila* (2)
hispid bird's-beak, *Cordylanthus mollis* ssp. *hispidus* (2)
soft bird's-beak, *Cordylanthus mollis* ssp. *mollis* (1)
silky cryptantha, *Cryptantha crinita* (2)
recurved larkspur, *Delphinium recurvatum* (2)
diamond-petaled poppy, *Eschscholzia rhombipetala* (2)
Butte fritillary, *Fritillaria eastwoodiae* (2)
fragrant fritillary, *Fritillaria liliacea* (2)
adobe lily, *Fritillaria pluriflora* (2)
Brewer's dwarf-flax, *Hesperolinon breweri* (2)
Northern California black walnut, *Juglans californica* var. *hindsii* (2)
Ahart's rush, *Juncus leiospermus* var. *ahartii* (1)

C-104032

C-104032

Plants Continued

Contra Costa goldfields, *Lasthenia conjugens* (1)
delta tule-pea, *Lathyrus jepsonii* var. *jepsonii* (2)
legenere, *Legenere limosa* (2)
Mason's lilacopsis, *Lilaeopsis masonii* (2)
veiny monardella, *Monardella douglasii* ssp. *venosa* (2)
Ahart's whitlow-wort, *Paronychia ahartii* (2)
closed-lip (closed-throated) beardtongue, *Penstemon personatus* (2)
Gairdner's yampah, *Perideridia gairdneri* ssp. *gairdneri* (2)
California beaked-rush, *Rhynchospora californica* (2)
valley sagittaria, *Sagittaria sanfordii* (2)
Tracy's sanicle, *Sanicula tracyi* (2)
Butte County sidalcea, *Sidalcea robusta* (2)
Butte County (western) catchfly, *Silene occidentalis* ssp. *longistipitata* (2)
showy Indian clover, *Trifolium amoenum* (1R)
caper-fruited tropidocarpum, *Tropidocarpum capparideum* (2*)
El Dorado mule-ears, *Wyethia reticulata* (2)

(E)--Endangered (T)--Threatened (P)--Proposed (CH)--Critical Habitat
(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(1R)-Recommended for Category 1 status.
(2R)-Recommended for Category 2 status.
(*)--Listing petitioned.
(*)--Possibly extinct.

C-104033

C-104033

Section 7(a): Consultation/Conference
Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species; 2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and 3)Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

Section 7(c): Biological Assessment - Major Construction Activity[1]
Requires Federal Agencies or their designees to prepare a Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action[2] on listed and proposed species. The process begins with a Federal agency requesting from FWS a list of proposed and listed threatened and endangered species. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the list, the accuracy of the species list should be verified with the Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

We recommend the following for inclusion within the BA: an on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities, and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of indirect effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

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[1]A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332(2)C).

[2]"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

C-104034

C-104034