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106th Congress, 2d Session – – – – – – – – – – – – House Document 106–188

YUBA RIVER BASIN, CALIFORNIA

COMMUNICATION

FROM

ASSISTANT SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY DATED NOVEMBER 25, 1998, SUBMITTING A REPORT WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS

FEBRUARY 1, 2000.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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U.S. GOVERNMENT PRINTING OFFICE
★63–581 WASHINGTON : 2000

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

0 2 DEC

REPLY TO
ATTENTION OF

Honorable J. Dennis Hastert
Speaker of the House
of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

Section 101 (a) (10) of the Water Resources Development Act (WRDA) of 1999 authorized a flood damage reduction project for the Yuba River Basin, California. The proposal is described in the report of the Chief of Engineers dated November 25, 1998, which includes other pertinent reports and documents, including the views of the State of California and the Department of the Interior. The Secretary of the Army supports the authorization and plans to implement the project through the normal budget process.

The authorized project would provide protection from flooding of the Yuba and Feather Rivers and would consist of modifications to the Sacramento River Flood Control Project. An estimated 200-year level of flood protection would be provided for the communities of Linda and Olivehurst (Reach 1), and for the area around Best Slough/Lower Reclamation District No. 784 (Reach 2). The project would also provide an estimated 300-year level of flood protection for the city of Marysville (Reach 3). In reaches 1 and 2, the project would involve about 6.7 miles of new and deeper slurry walls in existing levees, deepening about 9 miles of levee interior toe drains, and constructing or modifying about 9.5 miles of berms and levees along sections of the Yuba and Feather Rivers. In reach 1, the existing levee would also be raised by up to 0.8 feet in three sections, for a total distance of about 1.5 miles. In reach three, the project would involve constructing about 5 miles of slurry walls and berms along the ring levee protecting the city of Marysville. Measures to mitigate for adverse fish and wildlife impacts associated with the construction of the proposed project are included in the plan. The authorized project differs from the national economic development plan in that the recommended plan would provide a lower level of flood protection for reach 1. The lower level of protection was recommended at the request of the non-Federal sponsor. The recommended improvements in each of the three reaches are economically justified.

At October 1999 price levels, the Army Corps of Engineers estimates the total first cost of the project at $27,300,000. Following the cost sharing provisions of WRDA 1986, as amended by Section 202(a) WRDA 1996, the

Federal share of project costs would be about $17,745,000, and the non-Federal share would be about $9,555,000. The non-Federal sponsor, the State of California Reclamation Board, will operate and maintain the completed project, and will also develop and adopt a comprehensive flood plain management plan for the project area.

The non-Federal sponsor has already constructed some levee improvements in reaches 1 and 2, and has requested credit for this work in accordance with Section 104 of WRDA 1986. Preliminary approval of the credit was provided in October 1996 before construction began. The estimated credit is about $2,700,000, which represents the estimate of the costs had the levee improvements been constructed as a Federal project. In accordance with Section 104 of WRDA 1986, the credit is not available against the required 5 percent cash contribution, but is available against the cost of lands, easements, rights-of-way, and relocations, and for any additional cash necessary to realize the 35 percent minimum non-Federal contribution. The estimated credit is reflected in the cost sharing shown above.

The Chief of Engineers has found that the improvements undertaken by the non-Federal sponsor are integral to and compatible with the authorized project. The amount of the final credit will be subject to an audit of the sponsor's actual expenses. This credit will also be subject to the requirements of Section 102 of Public Law 106-60, the Fiscal Year 2000 Energy and Water Development Appropriations Act.

The Office of Management and Budget advises that there is no objection to the submission of this report to the Congress. A copy of its letter is enclosed in the report.

Sincerely,

Joseph W. Westphal
Assistant Secretary of the Army
(Civil Works)

Enclosure

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

SEP 27 1999

Honorable Joseph W. Westphal
Assistant Secretary of the Army for Civil Works
Pentagon - Room 2E570
Washington, DC 20310-0108

Dear Dr. Westphal:

As required by Executive Order 12322, the Office of Management and Budget has completed its review of your recommendation for the navigation improvements project at the Yuba River Basin, California, dated June 7, 1999.

The recommendation for this project is consistent with the policies and program of the President. The Office of Management and Budget does not object to the submission of this report to Congress.

Sincerely,

Kathleen Peroff
Deputy Associate Director
Energy and Science Division

COMMENTS OF THE STATE OF CALIFORNIA

State of California

GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

1400 TENTH STREET
SACRAMENTO 95814

PETE WILSON
GOVERNOR

PAUL F MINER
DIRECTOR

August 14, 1998

U.S. Army Corps of Engineers
Policy Review Branch, Policy Division
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, VA 22315-3861

RE: Yuba River Basin (California) FEIS/FEIR
SCH# 92123076

Gentlemen:

This letter confirms that the EIS/EIR for the referenced project has been reviewed by the State of California consistent with the intergovernmental review process established under Presidential Executive Order 12372. Affected state agencies have had an opportunity to provide their comments on the project.

If you have any questions concerning this matter, please give me a call at (916) 445-0613.

Sincerely,

ANTERO A. RIVASPLATA
Chief, State Clearinghouse

COMMENTS OF THE DEPARTMENT OF THE INTERIOR

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

ER 98/362

JUL 9 1998

Mr. David B. Sanford, Jr.
Chief, Policy Division
U.S. Army Corps of Engineers
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, VA 22315-3861

Dear Mr. Sanford:

The Department of the Interior has completed its review of the Chief of Engineers Proposed Report, final environmental statement, and other pertinent reports for the Yuba River Basin, Yuba County, California.

We have no comments on the proposed report and no objection to the proposed project.

Sincerely,

Terence N. Martin
for

Willie R. Taylor
Director, Office of Environmental
Policy and Compliance

YUBA RIVER BASIN, CALIFORNIA

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PE (10-1-7a) 25 November 1998

SUBJECT: Yuba River Basin, California

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on the study of flood damage reduction improvements in the Yuba River Basin, California. It is accompanied by the report of the district and division engineers. These reports have been prepared in partial response to the authority given in Section 209 of the River and Harbor Act of 1962 for surveys for flood control and allied purposes in the Sacramento River Basin and streams in northern California draining into the Pacific Ocean. The Yuba River is a tributary of the Sacramento River. Preconstruction engineering and design activities for the Yuba River Basin, California, project will be continued under this authority.

2. The reporting officers recommend authorization of a plan to provide flood protection from the Yuba and Feather Rivers. The recommended plan would provide protection from a flood having 1 chance in 200 of occurring in any given year along the Yuba and Feather Rivers in reach 1, the area around and including the communities of Linda and Olivehurst, and reach 2, the area around Best Slough/Lower Reclamation District No. 784. The plan would also provide protection from a flood having 1 chance in 300 of occurring in any given year in reach 3, the city of Marysville. In reaches 1 and 2, the major features of the recommended plan include constructing a combination of new and deeper slurry walls for a distance of 6.7 miles, deepening 9 miles of interior toe drains, and constructing or modifying 9.5 miles of berms along sections of the Yuba and Feather Rivers. The levee will be raised slightly in reach 1 from 0.5 foot to 0.8 foot in 3 sections for a total length of about 1.5 miles. In reach 3, the major feature of the recommended plan includes constructing about 5 miles of slurry walls and berms along the ring levee protecting the city of Marysville. Mitigation for project construction includes 2.98 acres for the loss of woodland habitat and 0.37 acre for threatened and endangered species. Mitigation for this project would utilize credit at the existing preservation banks established for the Sacramento River Flood Control, Phase II, Project.

3. The first cost of the recommended plan, based on October 1997 prices, is estimated at $25.850,000, of which $16,861,000 would be Federal and $8,989,000 would be non-Federal. Based on an interest rate of 7 1/8 percent, amortized over 50 years, average annual benefits and costs are estimated at $5,379,000 and $2,066,000, respectively, with a resulting overall benefit-cost ratio of 2.6. Reaches 1 and 2 are hydraulically linked and, therefore, are not separable elements. Reach 3 could be constructed as a separable project. The first cost and benefit-cost ratio for recommended work in reaches 1 and 2 is $15,460.000 and 1.5, respectively. The first cost and benefit-cost ratio for recommended work in reach 3 is $10.390,000 and 4.3, respectively.

4. The recommended plan differs from the National Economic Development (NED) plan in that the recommended plan provides a lower level of protection to reach 1 and is less costly. The recommended plan provides protection from a flood having 1 chance in 200 of occurring in any given year in reach 1, whereas the NED plan provides protection from a flood having 1 chance in 250 of occurring in any given year in reach 1.

5. As provided in Section 104 of the Water Resources Development Act (WRDA) of 1986, the reporting officers recommend that the non-Federal sponsor for flood control, State of California Reclamation Board, receive credit for work carried out which is integral to the plan recommended for authorization. This credit was approved in concept by the Assistant Secretary of the Army for Civil Works on 4 October 1996, contingent upon the requirements of section 104 and project authorization. In advance of the completion of the feasibility study, the State of California Reclamation Board with assistance from the Yuba County Water Agency provided funds to the Army Corps of Engineers to construct slurry walls and berms in reaches 1 and 2 in conjunction with the Sacramento River Flood Control, Phase II, Project. This advance work in reaches 1 and 2 is integral to the recommended plan and, therefore, would be eligible for credit against the non-Federal share of project costs. The advance work consists of approximately: 2.37 miles of new and deeper slurry walls in reach 1; 4.23 miles of berms in reaches 1 and 2; and 2.43 miles of new and deeper slurry walls in reach 2. Since the non-Federal sponsor made the decision to implement the advanced work before the NED plan was fully developed in the feasibility study, the design depth of the slurry walls was based on preliminary data. As a result, the slurry walls were constructed to a depth less than required by the NED plan in reach 1, thus precluding the NED plan in reach 1 from being an economically viable alternative. With the advance slurry wall work in place in reach 1, additional slurry wall deepening required to support the NED plan in reach 1 is economically unjustified. Consequently, the recommended plan provides the highest attainable level of flood control protection consistent with the decision to do advanced work. The estimated section 104 credit of $2,700,000 is reflected in cost sharing shown above for the

recommended plan. The amount of credit will be the actual cost of the work the Government constructed for which the non-Federal sponsor provided funds.

6. Washington level review indicates that the plan developed is technically sound, economically justified, and environmentally and socially acceptable. The plan conforms with essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other Administration and legislative policies and guidelines. Also, the views of interested parties, including Federal, State, and local agencies have been considered.

7. I generally concur in the findings, conclusions, and recommendations of the reporting officers. Accordingly, I recommend that the proposed improvements for flood damage reduction for the Yuba River Basin, California, project be authorized subject to cost sharing as required by Section 103(a) of WRDA 1986, as amended by Section 202(a) of WRDA 1996. I further recommend that the non-Federal sponsor for flood control receive credit under Section 104 of WRDA 1986, subject to an audit of the sponsor's actual expenditures. My recommendation is subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including the following requirements:

a. Provide a minimum of 35 percent, but not to exceed 50 percent of total project costs allocated to structural flood control as further specified below:

(1) Enter into an agreement which provides, prior to construction, 25 percent of design costs;

(2) Provide, during construction, funds needed to cover the non-Federal share of preconstruction engineering and design costs;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project structural flood control costs;

(4) Provide all lands, easements, and rights-of-way, with suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the project;

(5) Provide or pay to the Federal Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features

and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(6) Provide, during construction, any additional funds as necessary to make its total contribution equal to 35 percent of total project costs allocated to structural flood control;

b. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the project or completed functional portion of the project, including mitigation features at no cost to the Federal Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

d. Comply with Section 221 of Public Law 91-611, as amended, and Section 103 of Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

e. Hold and save the United States free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;

f. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR), Section 33.20;

g. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the operation, maintenance, repair, replacement, and rehabilitation of the project. However, for lands that

the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

h. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the operation, maintenance, repair, replacement, or rehabilitation of the project;

i. As between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

j. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for the construction, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

k. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of floodplain management plans.

l. Provide 35 percent of that portion of total cultural resource preservation, mitigation, and data recovery costs attributable to structural flood control that are in excess of 1 percent of the total amount authorized to be appropriated for structural flood control;

m. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

n. Prescribe and enforce regulations to prevent future obstruction of or encroachment on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project;

o. Not less than once each year, inform affected interests of the limitations of the protection afforded by the project; and

p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

8. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the State of California, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

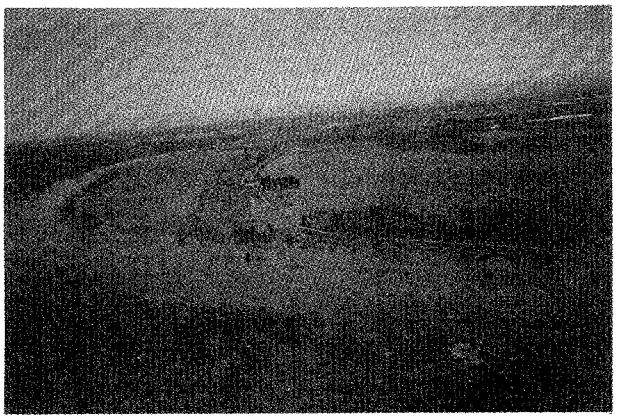
JOE N. BALLARD
Lieutenant General, U.S. Army
Chief of Engineers

YUBA RIVER BASIN INVESTIGATION, CALIFORNIA

April 1998

REVISED SEPTEMBER 1998

Final Feasibility Report and Appendixes



US Army Corps
of Engineers
Sacramento District
South Pacific Division

The Reclamation Board
State of California

8

YUBA RIVER BASIN INVESTIGATION,
CALIFORNIA

FINAL
FEASIBILITY REPORT
and
ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

April 1998

EXECUTIVE SUMMARY

INTRODUCTION

In 1991, the Corps initiated a feasibility study of water resources problems and opportunities in the Yuba River basin. A previous reconnaissance study completed in 1990 had identified a significant flood threat and determined that at least one alternative plan (levee raising) appeared to have Federal interest. This feasibility report describes the results of studies along the Yuba River and portions of the Feather River below Oroville Dam (see **plate A**). The non-Federal sponsor is the State of California Reclamation Board. The Yuba County Water Agency is also sponsoring the study through an agreement with the Reclamation Board.

STUDY AUTHORIZATION

The basic authority for the study is provided in the Flood Control Act of 1962 (Public Law 87-874), which directs the Corps of Engineers to study flood control problems along northern California streams including the Sacramento River and its tributaries.

FLOOD PROBLEM

The study area has experienced frequent floods in the past, many occurring before streamflow data were recorded. Prior to completion of Oroville Dam, large floods caused levee failures which resulted in severe damages to lands in the flood plain, including the city of Marysville and the surrounding area. The most destructive recorded floods on the Yuba and Feather Rivers occurred in 1950, 1955, 1986, and 1997. Major storms resulted in record flows, which eroded levee embankments and exceeded design levels. Subsequent levee breaks inundated or threatened urban and agricultural areas, forced thousands of residents to evacuate their homes, and resulted in major property damage and loss of life.

The long history of flooding in the Sacramento Valley shows that there will continue to be an ongoing threat to lives and property. Although existing upstream storage and flood control projects have prevented millions of dollars in damages, the potential for flood damage and loss of life remains.

PLAN FORMULATION

The study assumed that the flood control improvements proposed in the Sacramento River Flood Control System Evaluation (System Evaluation), Phase II - Marysville/Yuba City Area would be in place under with- and without-project

conditions. The System Evaluation includes structural modification of the flood control levees to return them to their originally authorized design. The levees in the study area were also assumed to be structurally stable.

Flood control alternatives were formulated by (1) identifying flood control measures, (2) developing and evaluating preliminary alternatives based on these measures, and (3) identifying several feasible alternative plans. Preliminary alternatives included modifying existing levees, implementing nonstructural measures, constructing a large or small bypass, reregulating Oroville and New Bullards Bar Reservoirs, regulating Englebright Reservoir, raising Englebright Dam and reregulating Englebright and Bullards Bar Reservoirs, and constructing a single-purpose or multiple-purpose reservoir at the Parks Bar or Narrows damsites.

Based on technical, economic, and environmental analyses of the preliminary alternatives, the only plan that was economically and environmentally feasible was modification of existing levees along the Yuba and Feather Rivers. Potential levee work included levee raising and placement of slurry walls, interior toe drains, and berms.

Using risk-based analysis, alternative plans were formulated to reduce flooding and flood damage in the study area. The risk-based analysis used three index areas - each with similar hydrologic, hydraulic, and economic characteristics - in the formulation. (These index areas are referred to as reaches 1, 2, and 3 and correspond to the Linda/Olivehurst, lower Reclamation District (RD) 784, and Marysville areas, respectively.) Plans were developed to provide a range of levels of flood protection in each reach. All proposed levee modifications were considered to be extensions and/or additions to the reconstruction work approved under Phase II of the System Evaluation. The proposed modifications would, where necessary, consider construction at the same time as the ongoing reconstruction work to avoid added costs associated with the duplication of materials if such work were done separately. Since work was identified to be constructed in conjunction with the System Evaluation work, the non-Federal sponsor pursued constructing this advanced work during the levee reconstruction project. The economic, technical, environmental, and social effects of the plans were then compared, and the three final alternatives identified were no action, the NED plan, and the recommended plan.

FINAL ALTERNATIVES

No Action

Under this alternative, the Federal Government would not implement a specific flood control plan in the study area. The flood control improvements in

the System Evaluation would be in place. However, the area's residents and property would continue to be at risk from flooding.

NED Plan

This alternative consists of (1) constructing or deepening slurry walls, deepening interior toe drains, constructing berms, and raising levees along sections of the Yuba and Feather Rivers and (2) constructing slurry walls and constructing berms along the ring levee around the city of Marysville. The NED plan for reach 1 had a benefit-to-cost ratio of 1.5 and optimized net benefits at a 1 in 250 annual event. The NED plan for reach 2 had a benefit to cost ratio of 1.4 and optimized net benefits at a 1 in 200 annual event. The NED plan for reach 3 had a benefit to cost ratio of 2.1 and optimized net benefits at a 1 in 300 annual event. In summary, the NED Plan would provide reach 1 with flood protection from a 1 in 250 annual event, reach 2 with protection from a 1 in 200 annual event, and reach 3 with protection from a 1 in 300 annual event.

Recommended Plan

The recommended plan provides consistent flood protection for reaches 1 and 2. This alternative involves (1) constructing or deepening 6.7 miles of slurry walls, deepening 9 miles of interior toe drains, and constructing or modifying 9.5 miles of berms along sections of the Yuba and Feather Rivers and (2) constructing about 5 miles of slurry walls and berms along the ring levee around the city of Marysville. The alternative would provide reaches 1 and 2 with flood protection from a 1 in 200 annual event and reach 3 with flood protection from a 1 in 300 annual event. The local sponsor's decision to construct the advanced work by deepening the slurry wall corresponding to the PNP of 82.5 prevents the NED plan corresponding to the PNP of 83.5 from being economically viable. Once the slurry wall is in place for the design, the cost associated with achieving deeper sections of slurry wall requires construction of an entire wall continuous to the new depth. The non-Federal sponsor made the decision to do advanced work before the NED plan was identified.

THE SELECTED PLAN

The recommended plan is the selected plan and is supported by the non-Federal sponsor. The selected plan for RD 784 is similar to the NED plan, while the plans for the Linda/Olivehurst and Marysville areas require less slurry wall, toe drain, and berm work than the NED plan. The cost estimate for the selected plan is lower than the NED plan. The selected plan represents the highest attainable flood protection considering the decision to do advanced work. At the time of the advanced work decision, the design of the advanced work provided more flood

protection than the preliminary NED plan estimate. Table ES-1 provides an economic summary of the selected plan, which has a benefit-to-cost ratio of 1.6 for Linda/Olivehurst, 1.1 for lower RD 784, and 4.3 for Marysville. The total first cost is $25,850,000 with a net benefit of $3.3 million.

Table ES-1. Economic Summary of Selected Plan[1]

Items	Reach 1	Reach 2	Reach 3	Total
First Cost	$12,810,000	$2,650,000	$10,390,000	25,850,000
Annual Costs	$1,031,000	$211,000	$824,000	2,066,000
Annual Benefits	$1,622,000	$230,000	$3,527,000	5,379,000
Net Benefits	$591,000	$19,000	$2,703,000	3,313,000
Benefit-Cost Ratio	1.6	1.1	4.3	2.6

[1]50-year amortization period; interest rate 7.125 percent; October 1997 price levels

COST SHARING

Current Federal regulations require non-Federal participation in the financing of projects. In accordance with the Water Resources Development Act of 1996, the non-Federal sponsors will provide lands, easements, rights-of-way, relocations, and disposal areas for construction and maintenance of the project, a cash contribution of 5 percent of the total project costs, and additional cash so that the total contribution is not less than 35 percent, but does not exceed 50 percent, of the total project first cost assigned to structural flood control. Based on these requirements, the total non-Federal share of the project cost is approximately $9.0 million (see Table ES-2). In addition, the non-Federal sponsor will be responsible for the operation and maintenance of the project.

As provided in Section 104 of the Water Resources Development Act of 1986, local interests can apply for credit against their share of the design and construction costs of the project for work constructed in conjunction with an authorized plan. The non-Federal sponsor has proceeded with advanced work to be constructed in conjunction with the levee work in Phase II of the System Evaluation. The estimated cost of the advanced work is $2.7 million, which has

been provided by the non-Federal sponsor for advanced work and is estimated to be creditable under Section 104. The sponsor's application for potential credit was approved for the advanced work by the Assistant Secretary of the Army (Civil Works) by memorandum dated 4 October 1996. This credit would apply towards the non-Federal share of the cost of the flood control project as described in this document (if authorized and funded for construction). The non-Federal share of the project with the Section 104 credit would be about $6.4 million.

Table ES-2. Cost Apportionment Including Non-Federal Credit

Adusted Basic Project (In 1,000s, October 1997 price levels)		
	Basic Project	Credit Project
Non-Federal 5% Cash	1,290	1,290
Non-Federal LERRD's	2,500	2,500
Non-Federal Additional Cash	5,230	5,230
Section 104 Construction (creditable)	0	2,700
Subtotal	9,020	9,020
Non-Federal Subtotal	0	6,320
Federal Construction	16,507	16,507
Federal Admin Costs	155	155
Federal Cultural Resources	168	168
Federal Subtotal	16,830	16,830
Total	25,850	25,850

LOCAL SUPPORT

The non-Federal sponsor strongly supports a plan for the area that would provide a high level of flood protection to the area, while minimizing any potential

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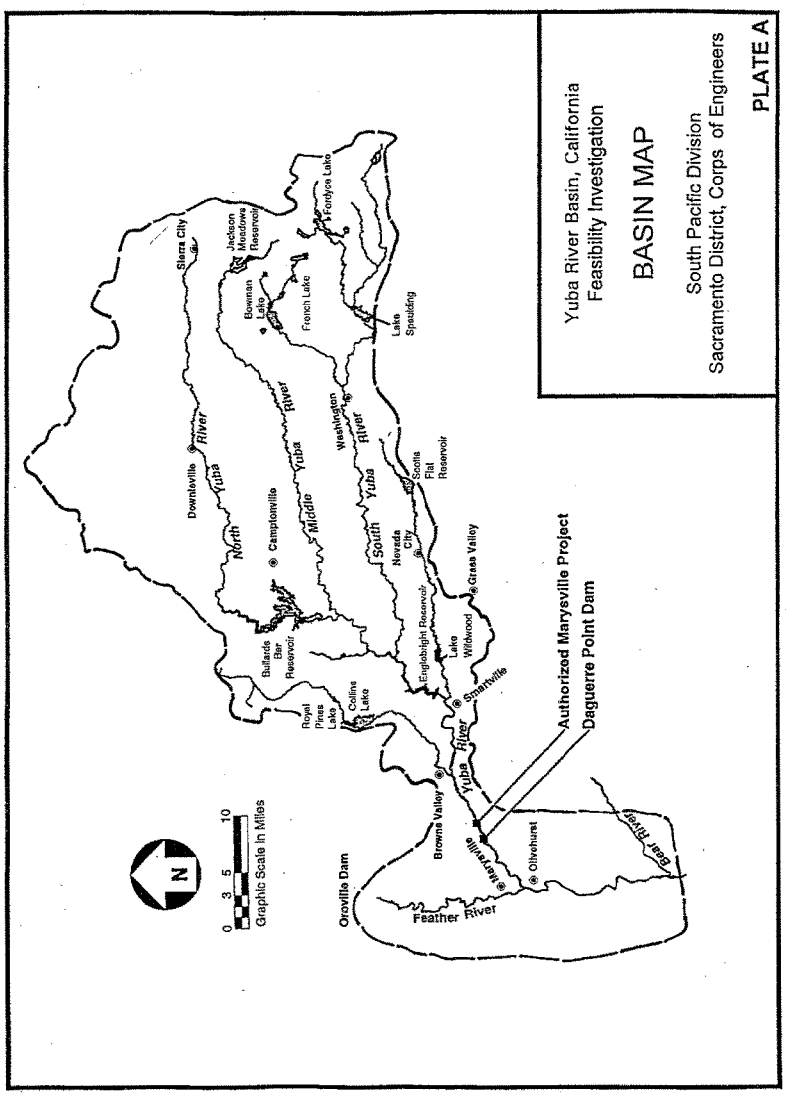
adverse environmental effects. The non-Federal sponsor has been active in the development of the selected plan.

CONCLUSIONS

Even with the existing flood protection provided by the Sacramento River Flood Control System, the Marysville and Linda/Olivehurst areas are still at risk of major flooding, as demonstrated by the recent flood in January 1997. Technical, economic, and environmental analyses indicate that there are feasible flood control plans that would reduce this flood threat. Based on these analyses and input from the non-Federal sponsor, a plan has been selected that includes slurry wall, toe drain, and berms along the Yuba and Feather Rivers. The total investment cost for the plan is about $28 million (the investment cost is interest during construction added to the first cost of $26 million).

The draft feasibility report and EIS/EIR were revised after the public review and comment period. Changes to the feasibility selected plan were documented in the final report. The final report with recommendations has been forwarded to the Corps Headquarters for Washington-level review and eventual transmittal to Congress for project authorization and funding.


Yuba River Basin, California
Feasibility Investigation
BASIN MAP
South Pacific Division
Sacramento District, Corps of Engineers
PLATE A
Authorized Marysville Project
Daguerre Point Dam
Graphic Scale in Miles
0 3 5 10
N
Sierra City
Jackson Meadows Reservoir
Bowman Lake
French Lake
Fordyce Lake
Lake Spaulding
Downieville
North Yuba River
Middle Yuba River
South Yuba River
Washington
Scotts Flat Reservoir
Nevada City
Grass Valley
Englebright Reservoir
Lake Wildwood
Smartsville
Camptonville
Bullards Bar Reservoir
Royal Oaks Lake
Collins Lake
Yuba River
Browns Valley
Marysville
Olivehurst
Bear River
Oroville Dam
Feather River

REPORT OF THE DISTRICT ENGINEER

CHAPTER I - INTRODUCTION

PURPOSE AND SCOPE

The purposes of this feasibility study are to (1) evaluate the need for additional flood protection in the Yuba River basin, (2) identify alternatives to increase the level of flood protection, and (3) determine the Federal interest in these alternatives based on costs, benefits, environmental effects, and local interest and support. The study area includes the lower Yuba River basin and portions of the Feather River basin below Oroville Dam. Basin and study area maps are shown on Plates 1 and 2. The study focused on flooding problems along these two rivers. This final feasibility report discusses the results of the studies for this investigation.

STUDY AUTHORITY

This study was conducted under the authority of the Flood Control Act of 1962 (Public Law 87-874). A portion of the act reads as follows:

> The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the following named localities: Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provision of Title III of Public Law 85-500.

STUDY PARTICIPANTS AND COORDINATION

The study was initiated in response to a request from the Yuba County Water Agency (YCWA). The Corps of Engineers conducted the study, formulated and evaluated flood control alternatives, and prepared this report. Study activities were coordinated with the non-Federal sponsors, local interests, and other agencies. They provided information on existing and future development and environmental resources and cooperated in developing the flood control alternatives. The non-Federal sponsor for the study is the State of California Reclamation Board.

PRIOR STUDIES AND REPORTS

Several prior studies and reports provided technical and environmental information on the existing resources, water resources problems, and opportunities in the study area.

Flood Plain Information, Feather and Yuba Rivers, Marysville-Yuba City, California

In 1968, the Corps completed this report on the flood situation along the Feather River from Oroville downstream to its confluence with the Yuba River, along the Yuba River from Daguerre Point Dam downstream to the same confluence, and in the Honcut Creek and Jack and Simmerly Sloughs areas. The report (1) summarized the records of the larger floods on the two rivers and (2) discussed the potential damage, public safety hazard, and depth and extent of flooding on the rivers and tributaries at various objective flows and standard project floods. This information was developed to help Federal, State, and local agencies manage the flood plain areas of the Feather and Yuba Rivers.

Flood Insurance Study, City of Marysville, Yuba County, California

In 1976, the Federal Insurance Administration completed this study of the potential flood hazards in the incorporated City of Marysville. Because of the extent of development within the community, all flooding sources were studied in detail. These sources included the Feather River, Yuba River, Jack Slough, Ellis Lake, and East Park Lake. The report (1) described the city and surrounding areas, (2) discussed historical flooding and sources of potential flooding, (3) described existing flood protection measures, and (4) documented the results of hydrologic and hydraulic analyses of the rivers and tributaries. This information was developed to convert the City to the regular Federal program of flood insurance and to assist local and regional agencies in managing areas within the flood plain.

Flood Insurance Study, Yuba County, Unincorporated Areas, California

In 1981, the Federal Emergency Management Agency completed this study of the potential flood hazards in the unincorporated areas of Yuba County. Flooding sources studied in detail included the Feather River from its confluence with the Yuba River upstream about 2.5 miles, Yuba River from its confluence with the Feather River upstream about 9 miles, Jack-Simmerly Slough, Linda and Olivehurst Drains, and the portion of Plumas lake east of State Highway 70. The report (1) described the county area, (2) discussed historical flooding and sources of potential flooding, (3) described existing flood protection measures, and (4) documented the results of hydrologic and hydraulic analyses of the rivers and

tributaries. This information was developed to convert Yuba County to the regular Federal program of flood insurance and to assist local and regional agencies in managing areas within the flood plain.

Yuba River Basin Reconnaissance Study

The Corps completed this study of the water resources and flooding problems and potential solutions in the Yuba River basin in 1990. The findings of preliminary technical, economic, and environmental studies were documented in a report entitled Yuba River Basin Investigation, California, Reconnaissance Report, March 1990. Several alternatives were formulated from a wide array of possible flood control measures: levee raising along the Feather and Yuba Rivers, regulating Englebright Reservoir, and constructing a multipurpose reservoir at the Parks Bar or Narrows damsites. Study results indicated that levee raising along the Feather and Yuba Rivers to provide at least a 150-year level of flood protection was economically feasible and had local support. As a result, this feasibility study was initiated to evaluate the reconnaissance findings in greater detail.

Sacramento River Flood Control System Evaluation

After levee failures during the February 1986 flood and numerous areas of levee piping and slumping, the Corps initiated an evaluation of the integrity of the levees in the Sacramento River flood control system. The purposes of the evaluation were (1) to evaluate the integrity and level of flood protection provided by the existing Sacramento River Flood Control Project levees, (2) to determine whether the levees currently function as designed, and (3) if reconstruction is needed, to determine the Federal interest in proceeding with construction. Due to the size and complexity of the project area, the evaluation was divided into five phases: Phase I - Sacramento Urban area, Phase II - Marysville/Yuba City area, Phase III - Mid-Valley area, Phase IV - Lower Sacramento area, and Phase V - Upper Valley area.

The first two phases of the Sacramento River Flood Control System Evaluation (System Evaluation) included the most heavily populated project areas, that is, the Sacramento urban and Marysville-Yuba areas. Phase I design and environmental studies near Sacramento were completed in 1992, and construction of levee improvements and floodwall repairs along the Sacramento River were completed in 1997. Phase II studies in the Marysville/Yuba City area were completed in 1993 and recommended construction work on levees along the Yuba and Feather Rivers and tributaries to bring the levees up to their original design. This remedial work included raising levees and constructing slurry walls, berms, and toe drains. The first contract, north of Marysville, was completed in 1996; the final two contracts are scheduled for completion in 1998.

Work on the remaining three phases is ongoing. The design memorandum for Phase III - Mid-Valley area was completed in 1996, and the levee work has been divided into four construction contracts. The work is scheduled to be completed in 1998. Phase IV - Lower Sacramento area studies completed in 1993 identified economically feasible work along several of the levees in the Delta, and Phase V - Upper Sacramento area studies completed in 1995 identified economically feasible work along two sections of the Sacramento River. Additional design and construction work for both Phases IV and V depend on execution of cost-sharing agreements and funding.

Emergency Response under P.L. 84-99

The Corps provides emergency response to natural disasters under Public Law 84-99, which covers flood control and coastal emergencies. Under this law, the Chief of Engineers is authorized to carry out disaster preparedness work; advance measures; emergency operations such as flood fighting, rescue, and emergency relief activities; rehabilitation of flood control works threatened or destroyed by floods; and protection or repair of Federally authorized shore protection works threatened or damaged by coastal storms.

During the flooding in 1986 and 1997, the Corps worked with other Federal, State, and local agencies to operate Corps facilities and provide personnel, supplies, and equipment during emergency floodfighting, evacuation, and repairs. In 1997, major problems in the study area included a levee breach near Arboga on the Feather River, a levee breach about 1 ½ miles above the confluence of the Bear and the Feather Rivers, and levee sloughing south of Yuba City near Laurel Road on the right bank of the Feather River. Levee repairs to return the levees to their original conditions have been completed.

Final Report of the Flood Emergency Action Team

The State Resources Agency completed this report in May 1997. The report documents the findings of the Governor's Flood Emergency Action Team, which was formed in response to concerns raised during the January 1997 floods in northern California. The report describes the location and extent of flooding, flood damages, and Federal, State, and local responses to the emergency. After the floods, the team held citizen advisory meetings in Yuba City, Modesto, Fresno, Santa Rosa, and Walnut Grove to solicit information, opinions, and recommendations from local residents who had been affected by the January 1997 floods. Based on its findings, the team makes specific recommendations to improve emergency response, flood plain management, and the existing flood control system.

The report includes the specific recommendation regarding this Yuba River Basin feasibility study:

> The FEAT recommends the Legislature fund the Reclamation Board to support the U.S. Army Corps of Engineers in a flood control feasibility study of the Yuba River Basin. A higher level of flood protection is needed for the urban areas of Linda/Olivehurst/Arboga.

CHAPTER II - STUDY AREA DESCRIPTION

SETTING

The study area is located in Yuba County about 50 miles north of Sacramento in northern California. The area encompasses the lower Yuba River basin and part of the Feather River basin and includes parts of the eastern Sacramento Valley and Sierra foothills. Elevations in the Yuba River basin range from 30 feet above sea level near the Feather River to over 9,100 feet in the Sierra Nevada. Located in the upper basin are the three forks of the Yuba River, Bullards Bar Lake, Englebright Lake, and other smaller lakes. Urban areas include Marysville, Linda, and Olivehurst.

EXISTING WATER RESOURCES PROJECTS

Located in or near the study area are several water resources projects. The larger projects are briefly described below.

Federal

Authorized Marysville Lake Project. Construction of the Marysville Dam was authorized by Congress in 1966 in the Flood Control Act of 1966 (Public Law 89-789). Corps studies of the Marysville Lake project reached the Phase I General Design Memorandum stage and then stopped due to lack of support by the State.

As designed, the Marysville Lake project would have 916,000 acre-feet of reservoir storage, including 240,000 acre-feet of flood control storage. The reservoir would cover 6,760 acres. The main dam would be located at Parks Bar on the Yuba River and would have a maximum height of 420 feet. An auxiliary dam would be located on Dry Creek, just upstream of its confluence with the Yuba River. A connecting channel would combine the storage behind the two dams. The Marysville project would be multipurpose and provide flood control, hydroelectric power, water supply, recreation, and wildlife enhancement.

Yuba River Debris Control Project. Daguerre Point Dam is located on the Yuba River about 11 miles upstream of Marysville. The dam was originally constructed by the Corps in 1906 to retain hydraulic mining debris, and operations were later modified to impound water for irrigation. The project was finally completed in 1935 and also included about 15 miles of training walls designed to keep the river within definite confines. The project was designed to prevent debris

from being carried downstream into the Feather and Sacramento Rivers. A fish ladder was later constructed to allow passage of fish.

Harry L. Englebright Dam and Lake. Originally known as Upper Narrows Reservoir, Harry L. Englebright Dam and Lake is on the mainstem of the Yuba River about 20 miles northeast of Marysville. The concrete arch dam and reservoir were authorized by the Rivers and Harbors Act of 1935 as part of the Sacramento River Debris Control Project. Completed in 1941, the dam and reservoir project was authorized primarily to contain hydraulic mining debris and has a debris storage capacity of 118 million cubic yards. Since hydraulic mining virtually ended in the early 1940's, the reservoir continues to have significant capacity for sediment storage. Englebright Lake is also operated for hydroelectric power generation. This hydropower is being used by the Pacific Gas and Electric Company and YCWA. Project lands and water are also used for water-oriented outdoor recreation.

Sacramento River Flood Control Project. The Flood Control Act of 1917 authorized the Sacramento River Flood Control Project, which is sponsored by the State Reclamation Board. The project consists of a comprehensive system of levees, overflow weirs, outfall gates, pumping plants, leveed bypass floodways, overbank floodway areas, enlarged and improved channels, and dredging in the lower reach of the Sacramento River. About 170 miles of levees in or near the study area are located on the Feather, Yuba, and Bear Rivers and Best Slough. Plate 3 shows the existing levee system in the Yuba City/Marysville area. Operation and maintenance of the project is by local interests.

The flood control project provides increased flood protection to about 800,000 acres of prime agricultural land; the cities of Colusa, Gridley, Live Oak, Yuba City, Marysville, Sacramento, Courtland, Isleton, Rio Vista, and numerous smaller communities; two transcontinental railroads, feeder railroads, and State and county highways. The value of land and improvements protected by the project is about $47.4 billion; about 2 million people live in the project area.

Sacramento River Flood Control System Evaluation, Phase II - Marysville/Yuba City Area. This project is the second phase of the comprehensive System Evaluation of the Sacramento River flood control system. The integrity of about 134 miles of flood control project levees were evaluated along the Feather and Yuba Rivers and their tributaries in Butte, Sutter, and Yuba Counties. Studies indicated that sections of the levees were susceptible to seepage problems and did not provide the design levels of flood protection. About 25 miles of levee reconstruction were required to restore the design level of flood protection provided by project levees. However, the work did not increase the level of flood protection to surrounding areas.

The work in Phase II includes raising levees and constructing toe drains, berms, and slurry cutoff walls at 13 sites (site 5 deleted) in the Phase II study area. These sites are located on (1) the Feather River along the east and west banks from the Thermalito Afterbay to the confluence of the Feather River and Sutter Bypass, (2) Bear River west of Highway 70 to the confluence with the Feather River, (3) south bank of the Yuba River, and (4) east levee of the Sutter Bypass between the Wadsworth Canal and the Feather River. The design is described in detail in the report entitled Sacramento River Flood Control System Project, Marysville/Yuba City Area, Phase II, Design Memorandum, Volumes I and II, January 1993. The work is scheduled to be completed in 1998.

Sacramento River Bank Protection Project. This project is an ongoing, long-term program that allows the Corps to use erosion control and setback levees to maintain the integrity of the Sacramento River Flood Control Project, reducing the need for emergency levee repair, periodic dredging, and loss of land due to bank erosion. Erosion control includes various forms of bank protection, but primarily consists of placing rock riprap to protect the levees. Setback levees involve moving existing levees farther from the river. The bank protection project area encompasses the 980 miles of levees along the east and west banks of the Sacramento River from Collinsville to Chico Landing; tributaries such as Steamboat Slough; and along the Feather, Bear, Yuba, and American Rivers; Sutter and Yolo Bypasses; and smaller tributary streams. The State Reclamation Board is the non-Federal sponsor for this project.

Central Valley Project. The Central Valley Project (CVP) is a multipurpose project that stores and transfers surplus waters primarily from the Sacramento and Trinity River basins to agricultural lands in the San Joaquin River and Tulare Lake basins. The project, authorized in 1937, was constructed and is operated by the U.S. Bureau of Reclamation. Among the additional benefits of the CVP are hydroelectric power, flood control, navigation, fish and wildlife enhancement, recreation, water quality, and environmental protection and enhancement. Physical features include reservoirs, pumping plants, canals, and electric generating facilities.

The main source of project water is Shasta Reservoir, completed in 1943, which stores 4.5 million acre-feet of water and reserves 1.3 million acre-feet of storage space during the flood season for flood control. A cooperative agreement between the U.S. Bureau of Reclamation and the Corps regulates the operation of the CVP reservoirs for flood control.

State of California

California State Water Project. The State Water Project (SWP) was authorized in 1959 under the California Water Resource Development Bond Act. The SWP includes dams and reservoirs, power plants, pumping plants, and aqueducts. The major feature of the SWP is Oroville Lake, located about 4 miles northeast of the city of Oroville. Oroville Reservoir was completed in 1967 as the highest earthfill dam in the United States and has 3,500,000 acre-feet of storage with 750,000 acre-feet reserved for flood control. Flood control operations in Oroville Reservoir are coordinated with Bullards Bar Reservoir on the North Yuba River according to flood control rules prescribed by the Corps.

Local

Yuba River Development Project. YCWA planned and constructed the Yuba River Development Project in the late 1960's. This project includes New Bullards Bar Dam and Bullards Bar Reservoir, the Middle Yuba - Oregon Creek Diversion Project, and the Narrows II hydroelectric plant at Englebright Dam. New Bullards Bar Dam was completed in 1969, is 645 feet high, and has a storage capacity of 960,000 acre-feet with a flood control reservation of 170,000 acre-feet. Bullards Bar Reservoir is a multipurpose project and provides irrigation, power, flood control, recreation, and fish and wildlife.

NATURAL AND SOCIOECONOMIC CONDITIONS

The existing natural and socioeconomic conditions in the study area are summarized below. A detailed discussion of these resources is included in the Environmental Impact Statement/Environmental Impact Report.

Basin Description

The topography of the Yuba and Feather River basins change as elevations increase from west to east. The Sacramento Valley is a flat flood plain, while the Sierra foothills consist of rolling-to-steep hills, low ridges, and narrow valleys. At higher elevations, rivers and creeks cut steep canyons in the Sierra Nevada. Rainfall runoff and snowmelt in the basin drain into the rivers and their tributaries and flow west into the valley. Plate 4 shows the historic flood basins of the Sacramento Valley.

The Yuba River drains about 1,350 square miles, of which about 480 square miles are above New Bullards Bar Dam on the North Fork Yuba River. The mountainous portion of the Yuba River basin is drained by the North, Middle, and South Yuba Rivers, which join at the foothill line above Englebright Reservoir to

form the mainstem Yuba River. Below Daguerre Point Dam, the Yuba River flows about 10 miles southwest through dredge tailings and level agricultural (flood plains) lands to its confluence with the Feather River at Marysville. Except for about 100 square miles of flat agricultural land on the valley floor below the foothill line, the basin consists mostly of hilly and mountainous terrain.

The Feather River drains about 3,600 square miles above Oroville Dam. Between Oroville and Marysville, the river drains about 370 square miles and flows south through relatively level and gently rolling terrain for about 40 miles. The Feather River floodway includes the lower portions of the north and south forks of Honcut Creek, and Jack and Simmerly Sloughs, all located north of Marysville.

Climate

The climate in the study area is typical of the Sacramento Valley, with hot, dry summers and generally cool, mild winters. The major flood season is from October through March, when rainfall accounts for 85 percent of the annual rainfall total. At Marysville, average annual rainfall is about 20 inches; to the east, rainfall averages increase with elevation.

Air Quality

The study area is located in the Sacramento Valley Air Basin which comprises the northern half of the Central Valley. The air basin is bounded by the Coast Range, Cascade Range, Sierra Nevada, and San Joaquin Air Basin. Air quality throughout the Sacramento Valley is affected by a combination of air contaminants, meteorological conditions, and the topographical configuration of the valley.

Sources of air pollutants include automobile emissions, agricultural activities such as plowing (dust) and burning of rice straw, light industry, and aircraft emissions at Beale Air Force Base. Types of pollutants include hydrocarbons, ozone, and dust and other particulates. These particulates are most highly concentrated between May and October, when a Pacific high pressure system dominates northern California and creates an inversion layer which traps pollutants near the ground surface. At the same time, south winds bring additional pollutants from the Sacramento area.

Air quality in Yuba County is in attainment for all Federal and State criteria pollutants except ozone and particulates less than 10 microns in diameter, which exceed State standards. In addition, although Yuba County is not officially recognized as a Federal attainment zone for ozone, the area has been in compliance with Federal standards since 1990. Therefore, while awaiting

redesignation by the U.S. Environmental Protection Agency, the area is considered to have "transitional" status for this pollutant.

Geology and Soils

Geologic conditions in the region include sedimentary rocks in the Sacramento Valley on the west, as well as metamorphosed Paleozoic and Mesozoic volcanic and sedimentary rocks in the Sierra foothills and upland Sierra Nevada, which have been intruded by Mesozoic igneous rocks. The lower basin is composed of alluvial fan and channel deposits from the rivers in the area. Adjacent to the Yuba and Feather Rivers in the valley area are the most recent sedimentary rocks.

Soil types in the region range from deep alluvium on the valley floor to deep rocky soils underlain with igneous or metamorphic rock at the higher elevations. Soils in the lower basin are alluvial, typical of soils found in the flood plain. Most of the soils on the valley floor are shallow to moderately deep, sloping, well drained soils with slowly permeable subsoils underlain with hardpan. These soils are used primarily for pasture, range, grains, and rice. Soils adjacent to the Yuba and Feather Rivers are mainly deep, level, well drained loamy Columbia-Holillipah, Shanghai soils. These soils are used for pasture, orchards, and row crops.

Water Quality

Water quality in the Yuba and Feather Rivers is affected by stormwater runoff, municipal wastes, erosion, and irrigation return flows. Overall water quality in the rivers is very good, and they are an excellent source of water supply. The quality of the ground-water is generally good although possible contamination exists from agricultural chemicals.

Vegetation and Wildlife

The study area contains a range of vegetation types: agriculture, riparian woodland, foothill woodland, grassland, and chaparral. Agricultural areas predominate near the Feather and Yuba Rivers in the Sacramento Valley. Willow-cottonwood riparian woodland is found along parts of the Yuba River and the Yuba Goldfield tailings. The foothill woodland community is found at elevations of 400 feet and above. This community consists of open woodland or savannah. In areas where there is water seepage or permanent streams, plant species more common to riparian areas are found. Very little perennial native grassland is left in the area. Extensive grazing and agricultural clearing have allowed the introduction of annual grasses. Chaparral may be found in ravines and

south-facing slopes, while the oak-digger pine community is found on ridges on the other slopes.

Wildlife is typical of the various habitats in the study area. Species of small mammals, birds, reptiles, and amphibians inhabit the area.

Fisheries

The Feather and Yuba Rivers are home to many species of cold and warmwater fish species. The rivers support a variety of resident and anadromous fish. Resident species include largemouth and smallmouth bass, Sacramento sucker, Sacramento squawfish, white catfish, bluegill, and white crappie. Anadromous species include chinook salmon, steelhead trout, American shad, striped bass, green and white sturgeon, and Pacific lamprey.

The Yuba River has an abundance of spawning habitat. The river below Englebright Dam contains excellent spawning gravels for both chinook salmon and steelhead trout.

Special Status Species

The Federal Endangered Species Act of 1973 (50 CFR 17) and the California Endangered Species Act of 1977 provide legal protection to plant and animal species listed as endangered, threatened, or rare (plants) under these acts. In addition to listed species, Federal, State, and local agencies maintain lists of species of special concern based on factors such as limited distribution, declining population size, or diminishing habitat acreage or value. Special status species with the potential to inhabit the study area were derived from the following sources:

- species listed, proposed for listing as threatened or endangered, or candidate species under the Federal Endangered Species Act as identified in a letter from the U.S. Fish and Wildlife Service dated August 1, 1997;
- species listed or proposed for listing by the State as threatened or endangered under the California Endangered Species Act;
- a search of the State Department of Fish and Game's Natural Diversity Database (1997);
- a review of other environmental documents prepared for sites in the study area; and

- a review of literature on species distribution and habitat requirements.

Based on habitat requirements and distribution and documented occurrences, the only special status species with the potential to inhabit the project area are the giant garter snake, northwestern pond turtle, American peregrine falcon, bald eagle, Aleutian Canada goose, Swainson's hawk, tricolored blackbird, and valley elderberry longhorn beetle.

Socioeconomic Conditions

Land use along the Feather and lower Yuba River is primarily agricultural in the Sacramento Valley with grazing in the Sierra foothills region. Agricultural uses include extensive orchards, row crops, and grain fields. While Marysville and the communities of Linda and Olivehurst are the main urban areas, residential developments and small residential tracts are scattered throughout the unincorporated areas. Conversion of agricultural use to urban development is ongoing, particularly in the Linda/Olivehurst area.

According to data from the Sacramento Area Council of Governments, the population of Yuba County was 64,100 in 1995. The county is projected to grow to 87,100 in 2010 and 105,361 in 2020. However, most of the growth is projected to be outside of Marysville, Linda, and Olivehurst. Table II-1 shows the current and projected population figures for these three communities.

Table II-1. Population Data for Marysville, Linda, and Olivehurst

Community	Year		
	1995	2010	2020
Marysville	13,229	14,375	15,224
Linda	14,102	20,041	25,468
Olivehurst	9,610	10,754	11,450

Source: Sacramento Area Council of Governments

Recreation

A variety of recreational activities are found in the Yuba River basin. Activities along the rivers and tributaries include fishing, boating, water skiing, rafting, hiking, picnicking, camping, sightseeing, and nature study when access is available. In addition, Yuba County has about 572 acres of neighborhood and community parks and recreation facilities that are accessible to the public. Of these acres, 267 acres are within the city of Marysville, 13 acres in Olivehurst,

and 104 acres in the Linda area. These facilities provide organized activities, equipment, educational opportunities, and hunting. The tops of levees are often used for bicycle riding and jogging.

Cultural Resources

Cultural resource surveys were initiated for Phase II of the System Evaluation in 1990 and completed in 1993. The Phase II study area was determined to have high potential for prehistoric sites and a moderate potential for historic sites. Two archeological sites were discovered and were determined eligible for the National Register of Historic Places.

Part of the Area of Potential Effect for the Yuba River basin study is the same as this previously surveyed area. A records search and field surveys of the remainder of the Area of Potential Effect will be accomplished prior to initiation of construction to identify any additional sites. If any sites are located during these surveys, these sites will be evaluated for their eligibility for the National Register. If any sites are determined to be eligible, an effect determination will be performed by the Corps, and consultation with the State Historic Preservation Officer will be initiated.

The main types of possible effects in this study are (1) physical destruction or damage during construction and (2) isolation or alteration of the character of the site's setting by the modified levees or berms.

Hazardous, Toxic, and Radiological Waste

A survey of potentially hazardous and toxic waste (HTRW) sites was conducted by the Corps for Phase II of the System Evaluation in March 1992. Part of the Yuba River basin study area along the Yuba and Feather Rivers is the same as this surveyed area. Before construction, a site specific survey for HTRW sites would be necessary of the areas not included in this 1992 survey.

Types of potential HTRW identified in the 1992 survey included empty pesticide containers stacked against the levees, aboveground storage tanks, 55-gallon drums, and nearby industry whose activities may have caused soil and/or ground-water contamination. The HTRW was located on private property, and according to county regulatory agencies, the landowner is responsible for waste on his property. As a result, the Phase II study recommended that the non-Federal sponsor work with the appropriate county agency to have the landowner remediate the sites prior to construction.

An environmental site assessment for potential HTRW sites was conducted by the Corps in September 1997. This assessment covered two sections of levee along the east bank of the Feather River and about 5 miles of ring levee around Marysville. A 100-foot corridor on either side of the levee crown was surveyed to try and identify all possible HTRW sites that could affect the project. Based on a literature review, discussions with local agencies, and a field visit, seven sites were identified that may require further investigation. Sites along the Feather River levee included (1) a burn barrel, scattered garbage, and pruning refuse, (2) garbage dump, two vehicle gas tanks, and two blue plastic drums, (3) large dump site, and (4) vehicle maintenance area. Sites along the Marysville ring levee included (1) the abandoned Hollywood Trailer Court, (2) Yuba River Sand Company, and (3) a pole-mounted transformer at the waterside toe of the levee. Although no HTRW contamination has been confirmed, the report recommended further investigation of all sites except the trailer court and the pole-mounted transformer.

WITHOUT-PROJECT CONDITIONS

The without-project conditions serve as the baseline for estimating and evaluating the beneficial and adverse effects of a potential flood control project. Estimates of future conditions were partly based on assumptions concerning construction of the System Evaluation project. The proposed reconstruction work on the Yuba River is located along the Yuba River south levee, extends to the confluence of the Yuba and Feather Rivers, continues along the Feather River east levees, and ends before the confluence with the Bear River.

Flood Control

Specific assumptions related to flood control include:

- The levee embankments of the existing Sacramento River Flood Control Project are assumed to be structurally stable at the existing design water-surface elevation. The Corps initiated a comprehensive evaluation of the structural stability of these project levees. Levee modifications under this System Evaluation do not include any changes in the existing design levee crown elevations. Since this levee modification work is authorized and scheduled for construction, the work is considered to part of the without-project conditions. Table II-2 shows the location and status of the project features of the System Evaluation.

- The levee reconstruction project, once in place, meets the Federal Emergency Management Agency's criteria for levee certification for the 1 in 100 annual event.

- Oroville and New Bullards Bar Dams are assumed to continue operating as currently designed.

- Emergency flood fighting efforts during major flood events and potential flood fight measures are not considered part of the without-project condition.

- The authorized Marysville Lake project was assumed not to be a project feature for the without-project conditions. The authorized Marysville Lake project was taken off the list to be deauthorized in 1992.

Table II-2. System Evaluation Work for the Sacramento River Flood Control Project Levees

Location	Levee Miles	Sacramento River Flood Control Project	
		Type of Reconstruction Work	Status of Work as of 1 April 1998
Yuba River Left Bank	0.00 to 0.28	Slurry wall 30'	Completed
	1.23 to 1.79	Slurry wall 25' to 30'	Completed
	1.77 to 2.18	Berm and drain; berm 6'x 10'	Under construction
	2.22 to 2.97	Slurry wall 20' to 28'	Completed
	2.92 to 3.56	Berm and drain; berm 5' x 10'	Under construction
	3.59 to 3.86	Berm and drain; berm 5' x 10'	Under construction
	4.00 to 4.26	Berm and drain; berm 6'x 10'	Under construction
Feather River Left Bank	26.07 to 25.12	Slurry wall 30' to 40'	Completed
	23.64 to 22.25	Berm and drain; berm 7'x 10'; raise levee	Under construction
	22.25 to 21.42	Berm and drain; berm 8'x 10'; raise levee	Under construction
	21.42 to 20.49	Berm and drain; berm 7'x 10'; raise levee	Under construction
	20.49 to 20.00	Raise levee	Under construction
	20.00 to 19.66	Raise levee; backfill ditch	Under construction
	19.66 to 19.03	Berm and drain; berm 8'x 10'; raise levee	Under construction
	19.03 to 18.84	Raise levee	Under construction
	18.84 to 18.37	Berm and drain; berm 6'x 10'; raise levee	Under construction
	18.37 to 17.58	Toe drain; raise levee	Under construction
	17.58 to 17.10	Berm and drain; berm 6'x 10'; raise levee	Under construction
	17.12 to 16.59	Slurry wall 31' to 40'; raise levee	Completed; under construction
	16.61 to 15.98	Berm and drain; berm 6'x 10'; raise levee	Under construction
Jack Slough Left Bank	0.00 to 0.25		
	0.25 to 0.68	Slurry wall 30'	Construction completed

Natural and Cultural Resources

No significant changes to natural resources are expected under without-project conditions. Yuba County strives to meet and maintain compliance with Federal, State, and local air quality and water quality standards and regulations.

Improvement of regional air quality will be considered in future land use decisions. No significant change in water quality in the Yuba and Feather River basin would likely occur. Vegetation and wildlife habitat in the study area would be similar to existing conditions. Any decline in aquatic resources would depend on such factors as rainfall, upstream water development, supply demands, and local pollutants.

Certain effects on cultural resources could be expected. Prehistoric and historic sites are often degraded or destroyed by urban expansion and agricultural practices. These sites could also be affected by natural processes such as erosion, root and rodent intrusion, flooding, and grazing. Vandalism through deliberate looting and collecting has been identified as a national problem.

Socioeconomic Conditions

No significant future residential, commercial, or industrial development is expected upstream of the study area during the 50-year period of analysis. However, additional development is assumed in the Marysville, Linda/Olivehurst, and surrounding rural areas, and this development could affect flood stages in these areas. This development would be due to new businesses, commerce, and industry; continued affordable housing; and adequate roadways for easy commuting to Sacramento and San Francisco.

Under without-project conditions, the population in the study area would continue to grow, especially in the outlying areas. The Sacramento Area Council of Governments projects a 2020 population of about 105,361. Most of the urban growth would be in the Linda/Olivehurst and rural areas, while the agricultural and industrial development would be concentrated in lower RD 784. New development in Marysville would be limited by the ring levee. However, the Federal Emergency Management Agency has no restrictions in Marysville because the level of flood protection is greater than the 1 in 100 annual event.

As regional urbanization pressures continue in the Sacramento area, migration to Yuba County would likely increase. New transportation facilities could be constructed in Yuba County to support the growth. These facilities include a third bridge to Sutter County, State Highway 70 through Yuba County and bypass at Marysville, a direct route between the Smartville area and Wheatland, and a State Highway 65 bypass at Wheatland.

CHAPTER III - PROBLEMS AND OPPORTUNITIES

FLOODING

Historic Flooding

According to historic records, frequent floods have occurred on the Feather and Yuba Rivers. Major floods occur during the winter months, usually due to intense rainfall after a period of soaking rains. Peak flows are often augmented by melting snow, especially during warm rains. Many large floods were noted in the 1800's, and Indian legends indicate thousands died during a large flood at the beginning of the nineteenth century. The elevation of the Marysville/Yuba City urban area was often 10 to 25 feet below the flood plain elevation due to accumulated mining debris in the rivers. Large floods in the study area in this century occurred in 1907, 1909, 1928, 1937, 1940, 1942, 1950, 1955, 1964, 1986, and 1997.

November 1950. Between November 21 and December 10, 1950, much destruction occurred on the Yuba River. On November 21, 1950, the south bank of the Yuba River broke near Hammonton, inundating 43,200 acres. Gold dredging near the break had reduced the Yuba River's flood capacity. Total loss due to the flooding was over $4 million (in 1950 dollars), with about $3.6 million below Englebright Dam.

December 1955. The most damaging flood recorded to date, based on loss of lives and damages, was the December 1955 flood (see Figure III-1). A peak flow on the Feather River of 180,000 cubic feet per second (cfs) was estimated, with a peak flow of about 155,000 cfs measured at the Marysville gage on the Yuba River. There was no upstream storage at this time. Simultaneous peaks occurred on both the Feather and Yuba Rivers. The Feather River levee at Yuba City broke on the right bank about 2 miles downstream of the mouth of the Yuba River at Shanghai Bend. The left bank levee of the Feather River also broke near Nicolaus. Marysville's levees were threatened. About 100,000 acres of land were inundated, including 95 percent of Yuba City. Thirty-eight people were killed in the Yuba City area, and two were killed in the Nicolaus area. About 3,300 homes were flooded; 6,000 cattle were killed; and more than 30,000 people were evacuated. Flood damage was estimated at $50.5 million in 1955 dollars. The flooded communities were disrupted for several months.

December 1964. During the December 1964 flood, the peak inflow into the nearly completed Oroville Reservoir was 253,000 cfs. Outflow from the newly

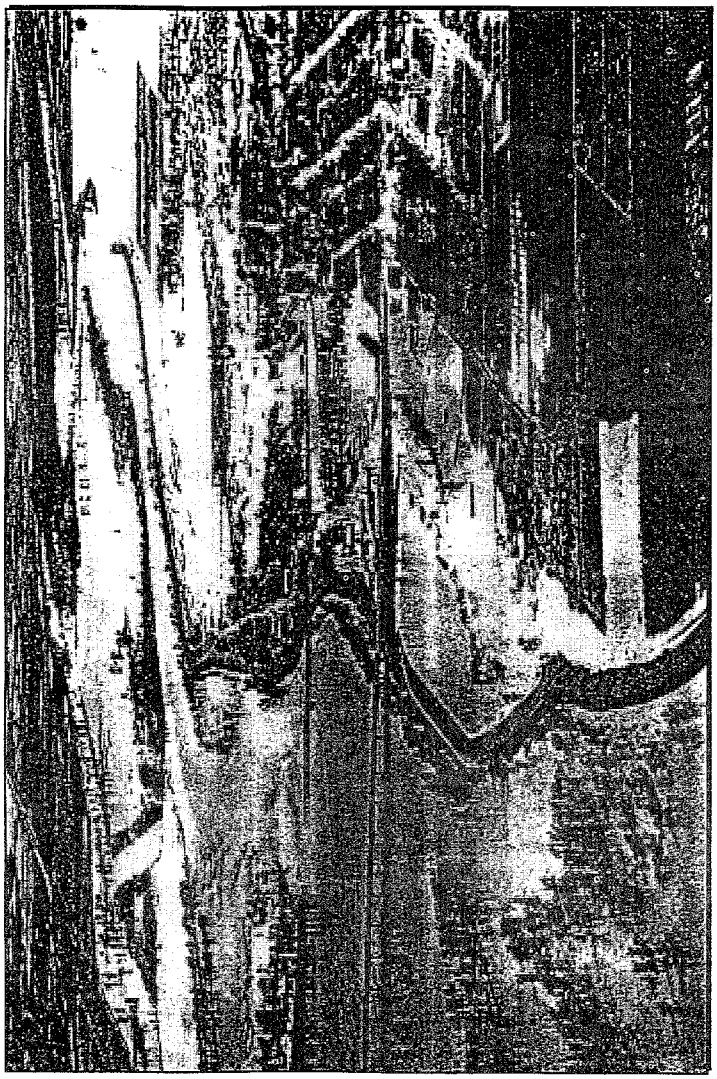


Figure III-1. Yuba City during the 1955 flood.

constructed Oroville Dam was reduced to 158,000 cfs. Peak flows on the Yuba River reached 180,000 cfs and encroached into the levee freeboard. New Bullards Bar Dam had not yet been constructed. The flood inundated about 25,000 acres of agricultural land in the Feather River floodway and within the Yuba River levees, causing damages of about $5 million (in 1964 dollars). Storage in the Oroville Reservoir allowed a low peak on the Feather River when the Yuba River peaked, which reduced the combined flows from the Feather and Yuba Rivers. As a result, the upstream backwater effect and the downstream peak flows were reduced.

February 1986. Peak flows on the Yuba River during the February 1986 flood were about 111,900 cfs (about a 30-year event). Peak flows at the Feather River mouth were estimated to be between a 1 in 80 annual to 1 in 90 annual event were recorded on February 19 and 20 from 6 p.m. to 6 a.m. Information from a YCWA report indicate that flows on the Middle and South Yuba Rivers were reduced by incidental upstream water supply reservoirs due to the previous dry season. Oroville Reservoir on the Feather River had peak inflows of 198,900 cfs and made controlled releases of 147,400 cfs. The 1986 event consisted of a closely spaced series of large rainstorms. There was little time between storms to make releases to regain flood storage space. Both Oroville and Bullards Bar Reservoirs were almost filled to flood storage capacity and nearly had to make releases of total inflow. On February 20, 1986, while the Feather River and Yuba River were receding, a section of levee near the community of Linda failed due to an unknown structural problem (see Figure III-2). In the communities of Linda and Olivehurst, about 24,000 people were evacuated. One person died; 32 people were injured; 895 homes and 150 businesses were destroyed; and 3,000 homes and 150 businesses were damaged. About $95 million (in 1986 dollars) in damages were estimated in the Yuba River area.

January 1997. The January 1997 flood was probably the largest in northern California since measured records began in 1906. The flood was notable in the sustained intensity of rainfall, volume of floodwater, and areal extent - from the Oregon border to the southern end of the Sierra Nevada. New flood records were set on many of the major Central Valley rivers.

Over the 3-day period around New Year's Day, warm moist winds from the southwest blowing over the Sierra Nevada poured more than 30 inches of rain onto watersheds that were already saturated by one of the wettest Decembers on record. Most of the large dams in northern California were full or nearly full within the first days in January.

Levees of the Sacramento River Flood Control Project sustained moderate to heavy damage in the January 1997 floods. In addition to breaks and relief cuts, levees sustained damage such as erosion on the landside due to overtopping and wavewash, which threatened levee stability; slope failures, sloughing, settlement,

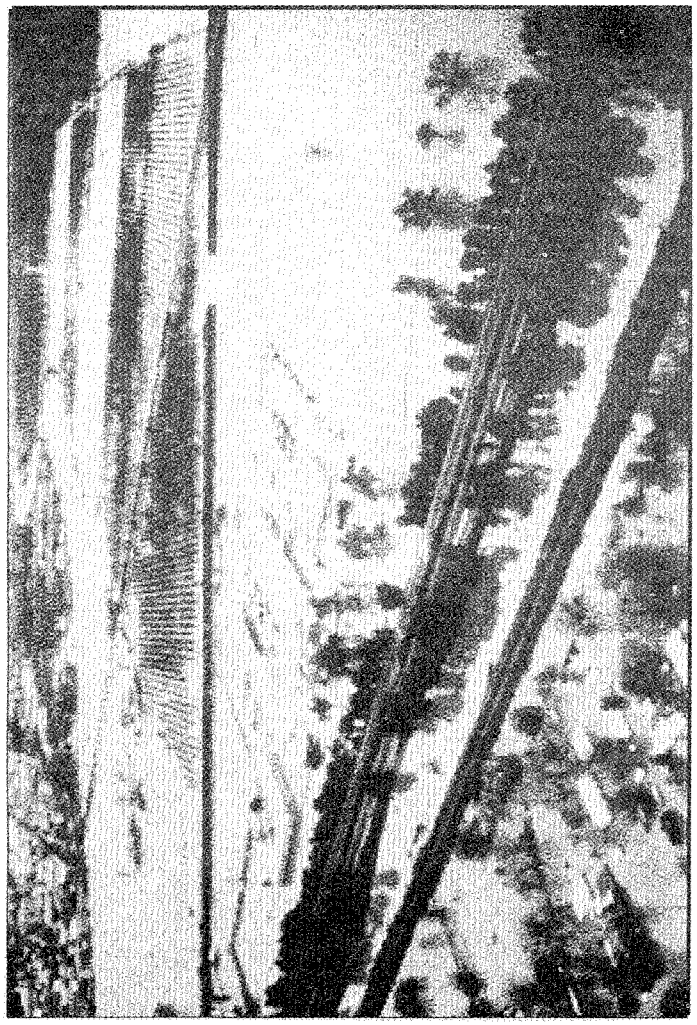


Figure III-2. Levee breach at Linda in the 1986 flood.

and sinkholes; and seepage damage from boils and seeps carrying levee and foundation soils.

The Corps responded to requests for emergency levee repairs or waged emergency flood fights at various locations in the Sacramento River system. Locations in the study area included a break and two relief cuts on the east levee of the Feather River and two breaks on the north levee of the Bear River. The break on the Feather River occurred about 6 miles south of Olivehurst on January 2, 1997, prompting the evacuation of about 15,000 people from Linda and Olivehurst. Figures III-3 through III-8 illustrate the magnitude of flooding in the Linda/Olivehurst and lower RD 784 areas.

Nearly 50,000 inhabitants of Yuba City, Marysville, and surrounding areas were evacuated because of fears over possible levee breaks.

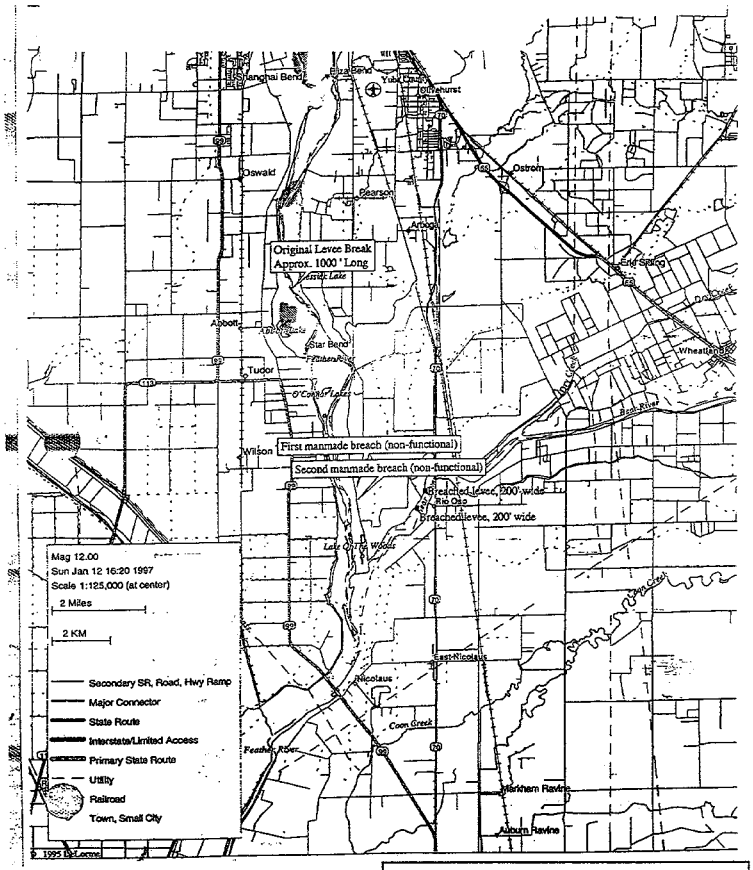
Future Flood Threat

The history of flooding in Marysville and the Linda/Olivehurst area shows that there will continue to be an ongoing flood threat to lives and property. The basin is subject to periods of intense rainfall and runoff events, and spring runoff may be augmented by snowmelt, especially during warm rain storms. Limited upstream storage capacity, high runoff peaks, and combined river and tributary flows stress existing levees and flood control systems. Levee breaks can happen unexpectedly, and floodwaters can inundate adjacent areas quickly and with little warning.

Urban and agricultural areas in the study area are at risk of levee failure, flooding, and damage to residences, businesses, and crops. Levee breaks on the Feather River could result in potential flood depths ranging from 2 to 7 feet in Linda/Olivehurst and 15 to 22 feet in the lower RD 784 area, and a break in the ring levee could inundate Marysville with 20 to 25 feet of water. Despite existing flood protection provided by the Sacramento River Flood Control System, the area is still vulnerable to major flooding as demonstrated by the recent flood in January 1997.

GEOMORPHOLOGY AND SEDIMENTATION

The Yuba and Feather Rivers were severely affected by the sedimentation from hydraulic mining in the Sierra Nevada during the last century. Historic accounts indicate that a discharge of about 700 million cubic yards of tailings into the Yuba River had caused over 15 feet of channel and flood plain aggradation near Marysville by about 1905.



Yuba River Basin Feasibility Study
Feather River Levee Breaks
January 1997
Sacramento District, Corps of Engineers

Figure III-3.

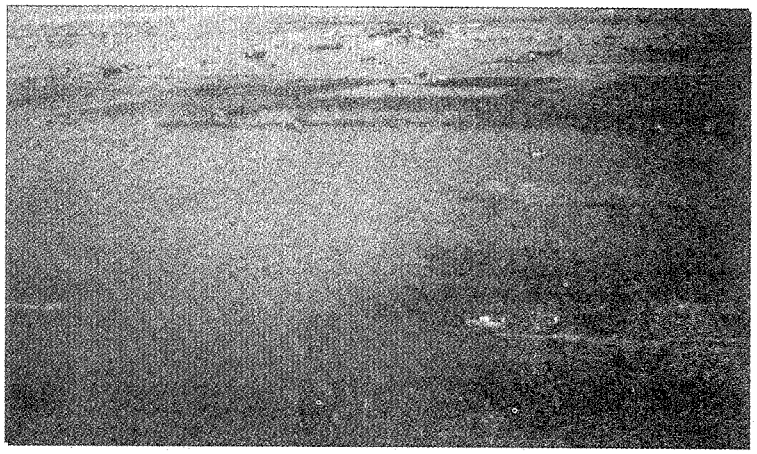


Figure III-4. Levee break on the Feather River with Linda / Olivehurst in top left corner in 1997.

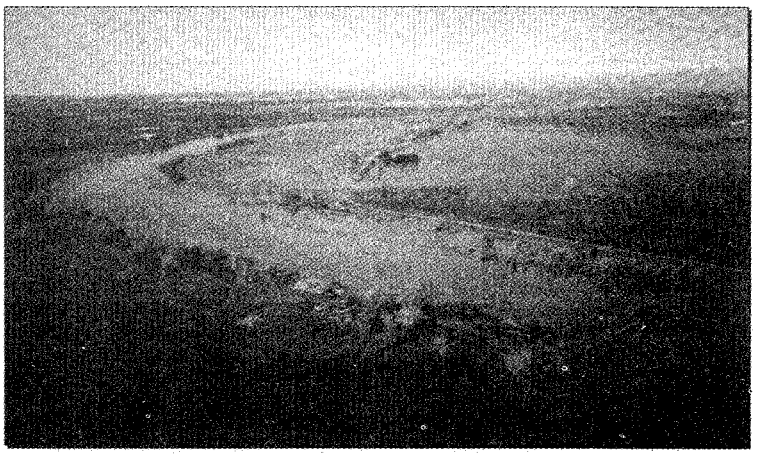


Figure III-5. Feather River looking upstream with Yuba City in the background in 1997.

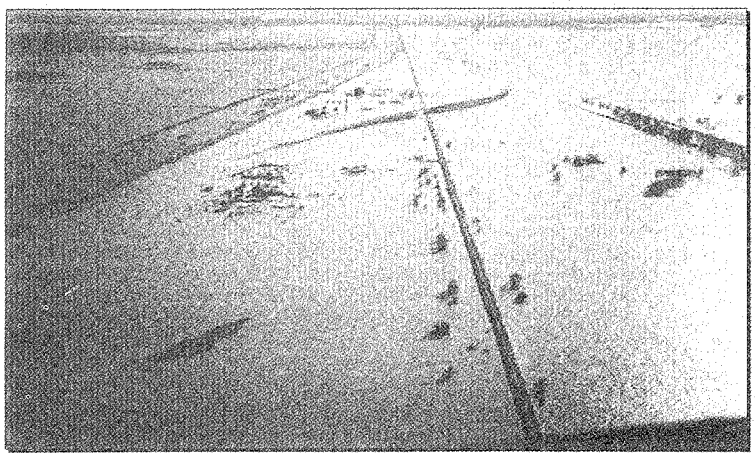


Figure III-6. Flooding in the vicinity of Highway 70 as it crosses over the railroad tracks in 1997.

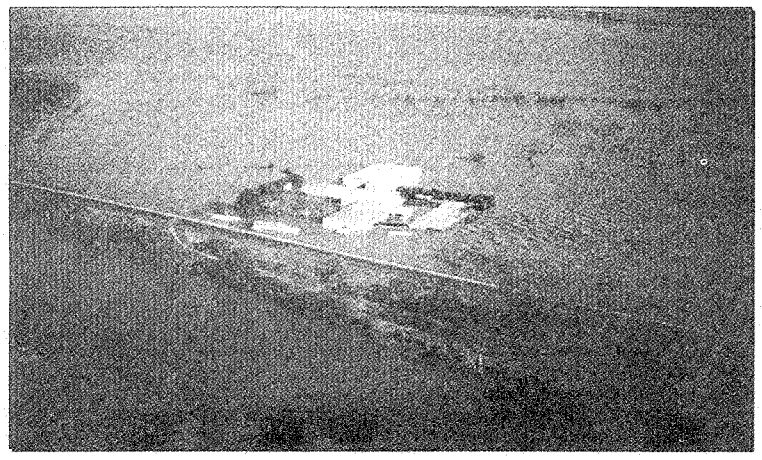


Figure III-7. Flooding along Feather River Boulevard just right of wood supply plant in 1997.

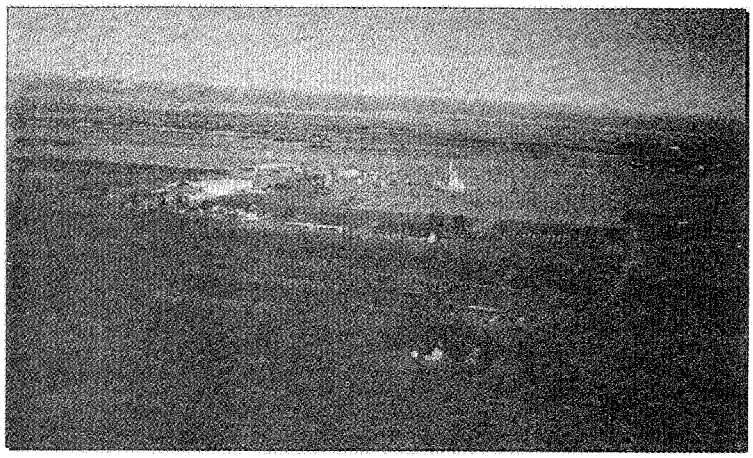


Figure III-8. Flooding in southern portion RD 784 area. Packing plant next to Feather River levee in 1997.

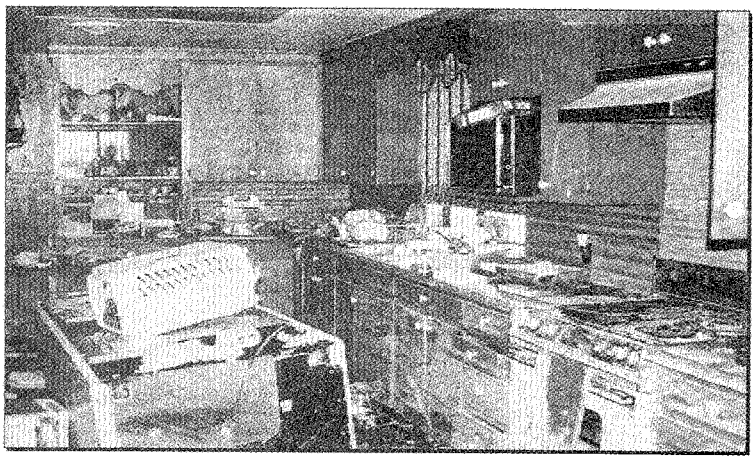


Figure III-9. Residential damage from flooding in the Lower RD 784 area in 1997.

Since the end of hydraulic mining, the general trend of the river has been degradation. The extent of the degradation has depended on (1) the California Debris Commission's efforts in the early 1900's to mitigate the effects of the hydraulic mining and (2) the development of water resource projects in the area. These projects regulate the flows in the rivers and streams, and Oroville and New Bullards Bar Dams also reduce the potential for watershed-produced sediment to be delivered downstream.

The Yuba River has continued to degrade although the extent of degradation varies along the study reach. The result has been a steepening of the channel bed. In addition, the reduction in sediment supply caused by dam construction, together with base level lowering at the Feather River confluence, has resulted in finer bar and riffle sediments. As a result, the Yuba River channel has become steeper and coarser.

Although the Feather River has degraded through the hydraulic mining debris into the underlying pre-mining flood plain sediments, there has been very little bank erosion or threat to the levees. The reason for this apparent lateral stability is that the sediment supply from the tributaries has maintained a sandbed channel with a symmetrical cross section along most of the study reach. (An asymmetrical cross section would result in bank failure and lateral migration of the river.)

The geomorphology of the rivers could be affected by development of flood control measures in the basin. Upstream storage or diversion could reduce the quantity of sediments washing downstream. In addition, measures could be incorporated into project design to reduce potential erosion of existing or proposed flood control structures.

WATER SUPPLY

The primary agency that monitors and regulates water supply in Yuba County is the YCWA. Numerous districts, as well as a few private companies and public utility corporations, are allotted set amounts of surface water for municipal, industrial, and/or irrigation needs in the study area. The existing storage and distributions systems store water during the annual rainy season to be released and distributed during the dry season, thus ensuring that seasonal water surpluses are converted to a reliable year-round supply for local and statewide areas.

However, projected population expansion and proposed development in the study area and statewide are expected to increase demands for additional water supplies for municipal, industrial, and agricultural uses. Additional surface water storage in upstream reservoirs would ensure that future urban needs are met and increase the ability of irrigation water users to make beneficial use of existing surface water. Increased storage capacity would also allow holding additional

water for a longer period in the season, thus making it available for irrigation at a time that is appropriate for crop needs. This would increase the use of surface water for irrigation in lieu of pumping ground water. Overdraft and lowering of water tables have occurred, especially during extended drought periods.

FISH AND WILDLIFE ENHANCEMENT

The Sacramento River system, including the Yuba and Feather Rivers, has historically been an important spawning area for anadromous fisheries including fall-run and spring-run chinook salmon, steelhead, and American shad. Although these fisheries are now declining in some areas due to degraded water quality, loss of accessible spawning habitat, and inadequate spawning ground conditions, the fisheries in the Yuba River have remained stable or actually increased.

Measures could be incorporated into a project to enhance conditions for anadromous fish on the lower Yuba River. Some of these measures include managing reservoir storage and flows to improve flows and water temperatures, creating or enhancing off-channel spawning and rearing habitat, modifying fish ladders at dams, and modifying fish screens at diversions.

RECREATION

Development of bicycle, equestrian, or hiking trails in connection with the proposed levee work could provide additional recreational opportunities, as well as an alternative means of transportation.

CHAPTER IV - TECHNICAL STUDIES

Various technical studies were used to analyze water resources problems and opportunities in the study area, as well as provide the basis for the plan formulation process. These technical studies included geomorphology and sedimentation studies, hydrological studies, flood plain analysis, environmental studies, economic studies, real estate studies, and basis of design studies. Details of the technical studies are included in appendixes to this report.

GEOMORPHOLOGY AND SEDIMENTATION

The Yuba and Feather River basins and channels are continuing to adjust to the effects of hydraulic mining activities of the late nineteenth century. Some of these adjustments include channel degradation, which may have the potential for detrimental effects on the functioning of the Sacramento River Flood Control Project. The geomorphology and sedimentation studies were conducted to address the stability of the study area levees for consideration of future flood control improvements. The objectives of these studies were to (1) determine the existing (pre-project) geomorphic, sediment transport, and channel stability conditions in the project reach, (2) identify potential short- and long-term effects of the proposed flood control project on sedimentation and channel stability through the reach, and (3) qualitatively determine potential project effects downstream of the reach with respect to geomorphic, sediment transport, and channel stability characteristics. The reach extends from Daguerre Point Dam (river mile (RM) 11) on the Yuba River downstream to the confluence with the Feather River, and from RM 30 (upstream of Marysville) downstream to RM 7 (confluence with Sutter Bypass) on the Feather River (see **Plate 5**). The Bear River, with its confluence with the Feather River at RM 12.2, is a principal tributary in the project reach.

The Feather, Yuba, and Bear Rivers were all severely affected by the accelerated sedimentation that occurred as a result of hydraulic mining for gold in the Sierra Nevada during the last century. This mining in the 1880's changed the rivers. Pressurized sprays of water sent immense quantities of sediment downstream. **Table IV-1** lists the historical events which have affected the Feather, Bear, and Yuba Rivers. The current geomorphology of the three rivers is due to the intensity and types of mining on each stream. The general effect of hydraulic mining was rapid aggradation of the river channel, and subsequent incision into the hydraulic mining debris. However, the engineering methods used to arrest the adverse effects of the sediment had different results on each river.

Bear River

The Bear River consists of a single channel that is strongly affected by backwater conditions generated at its confluence with the Feather River. In the project reach, the Bear River is a low sinuosity, sand-dominated system that aggraded due to hydraulic mining, and has subsequently eroded into that material.

Table IV-1. Historical Events on the Yuba, Feather, and Bear Rivers

Year	Event
1848	James Marshall discovers gold on the American River.
1853	Edward Matteson employs hydraulic mining techniques on American Hill.
1861	Invention of crinoline hole; water pressure tripled. Blasting used for first time in hydraulic mining.
1862	Major flood resulting in loss of agricultural lands. Subsequent levee construction.
1868	Channel beds of Feather and Yuba Rivers higher than streets of Marysville. More levee construction.
1875	Major flood results in levee breaks and burying of parts of Marysville.
1884	Sawyer decision prohibits tailings disposal into drainages.
1891	Onset of erosion of upper drainages.
1893	Caminetti Act results in formation of the California Debris Commission, which allows mining after construction of approved tailings impoundment.
1893	California Debris Commission empowered.
1906	Daguerre Point Dam constructed on Yuba River.
1910	Clearing, blasting, and realignment of the Yuba River.
1934	Caminetti Act amended to allow for construction of high dams.
1940	Englebright Dam on Yuba River constructed.
1950	New Camp Far West Dam on Bear River constructed.
1967	Completion of Oroville Dam on Feather River.

Figure IV-1 shows the river channel cross section in 1924, the degradation in the 1955 profile, and finally the steepening and eroding past the original 1924 cross-section.

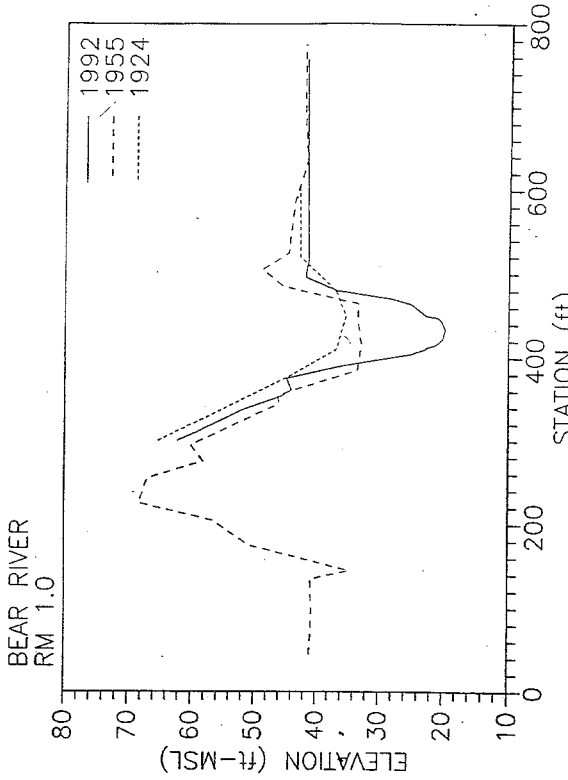


figure IV-1 Comparative cross sections from 1924, 1955, and 1992, RM 1.0, Bear River.

The source of hydraulic mining debris and the degradational effects in the Bear River basin are illustrated in **Figures IV-2 and IV-3**, respectively. Other effects from hydraulic mining in the Bear River basin are shown on **Figures IV-4 and IV-5. Figure IV-4** shows that nearly 25 feet of degradation has occurred since the 1890's. **Figure IV-6** shows survey data from 1940 and 1990 at RM 6.4. From 1940 to 1990 the lower Bear River degraded more than 20 feet. About 255 million cubic yards of gold-bearing material were mined by the hydraulic method and washed into the Bear River between 1849 and 1909. The Bear River aggraded up to 20 feet, burying the original channel.

Yuba River

The Yuba River received more sediment due to hydraulic mining than the Bear, upper Feather, and American Rivers combined. **Figure IV-7** shows the amount of material mined on the Feather, Bear, Yuba, and American Rivers between 1849 and 1909. Between 1849 and 1909, more than 600 million cubic yards of hydraulic mining material washed into the Yuba River. As a result, the Yuba River aggraded over 15 feet. Between the confluence with the Feather River and RM 2, the Yuba River is characterized by sediment storage on high relief bars, primarily sand-sized material (see **Figure IV-8**). **Figure IV-9** compares cross sections from 1906, 1912, and 1992 at RM 1.1. The difference in the cross-sections reflect degradation of over 20 feet between 1912 and 1992. **Figure IV-10** is a photograph of the E Street bridge at RM 1. Also in **Figure IV-10** are exposed and abandoned bridge footings from an old bridge. **Figure IV-11** compares the cross sections from 1899, 1906, 1912, and 1992, while **Figure IV-12** shows the view upstream at RM 3. Between 1899 and 1929, the Yuba River degraded at a rapid rate. Thirty years of mining had taken place before the California Debris Commission was empowered to regulate hydraulic mining. In the 1930's, the section of river near RM 3 was blasted by the California Debris Commission, which slowed the rate of degradation. Other attempts by the California Debris Commission to arrest the hydraulic mining effects are shown on **Figures IV-13** (Daguerre Point Dam) and **IV-14** (debris training walls).

Between 1957 and 1992, bed degradation continued on the Yuba River. During this time, the extent of degradation varied along the project reach, from zero feet at Daguerre Point Dam to almost 20 feet at the mouth of the river (perhaps only 15 feet if the data vary by 5 feet). The reduction in sediment supply caused by dam construction and base level lowering has resulted in steepening and coarsening of the Yuba River channel.

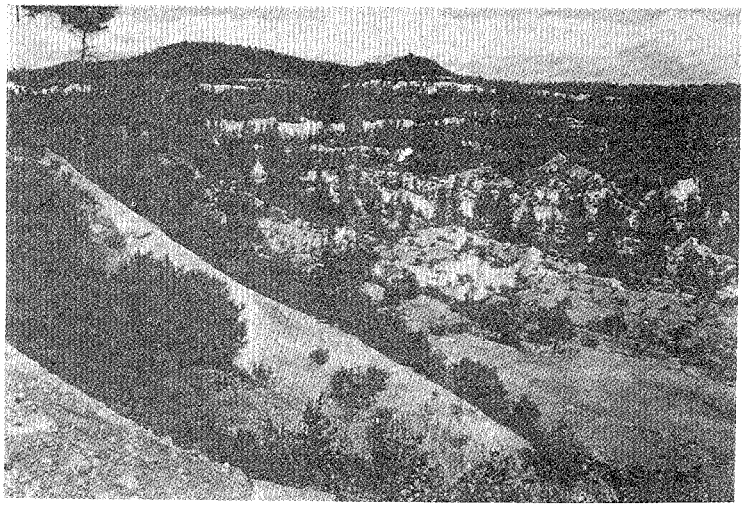


Figure IV-2. Source of hydraulic mining debris in the upper Bear River Basin.

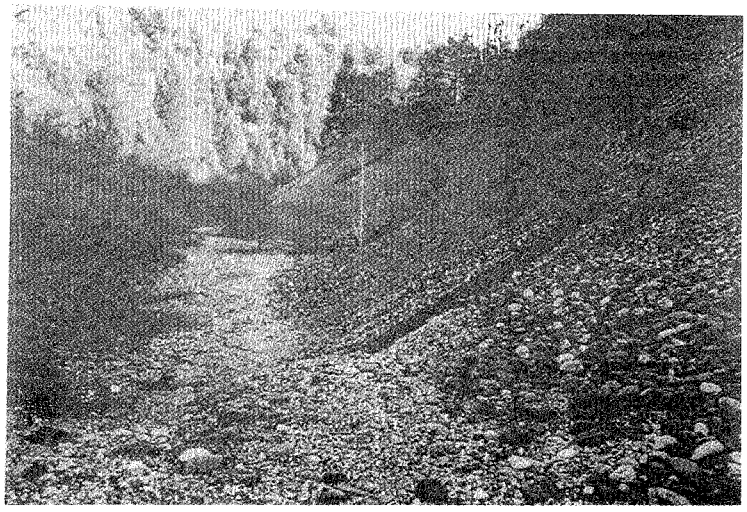


Figure IV-3. Missouri Canyon in upper Bear River Basin has degraded about 40 feet since the late 1880's due to hydraulic mining.

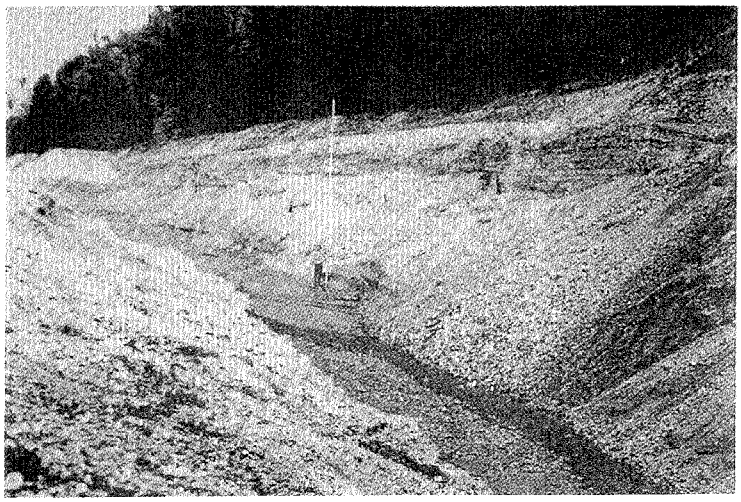


Figure IV-4. Approximately 25 feet of degradation has occurred in Greenhorn Creek in the Bear River Drainage Basin.

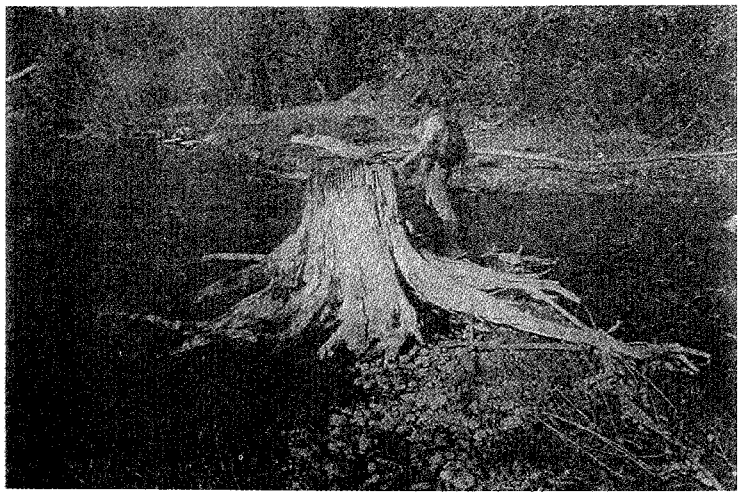


Figure IV-5. Exhumed tree stump provides evidence of degradation caused by hydraulic mining in the lower Bear River.

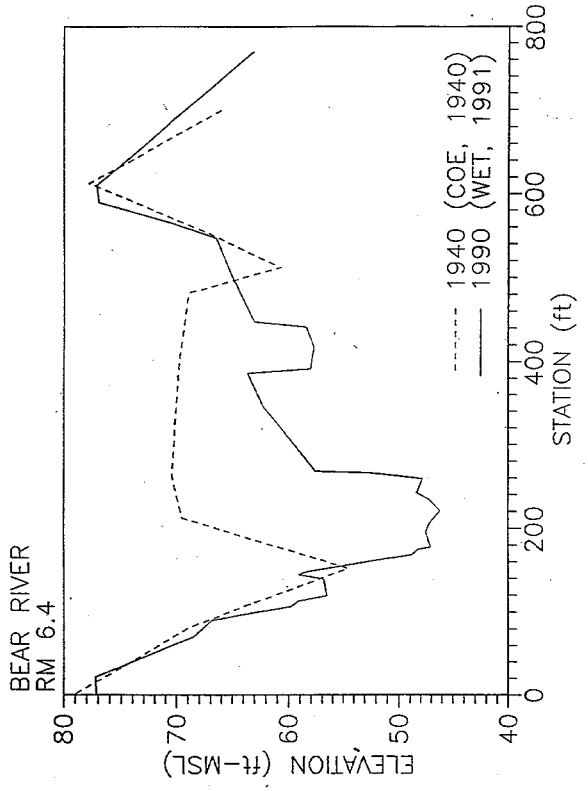


figure IV-6 Comparative cross sections from 1940 and 1990, RM 6.4, Bear River.

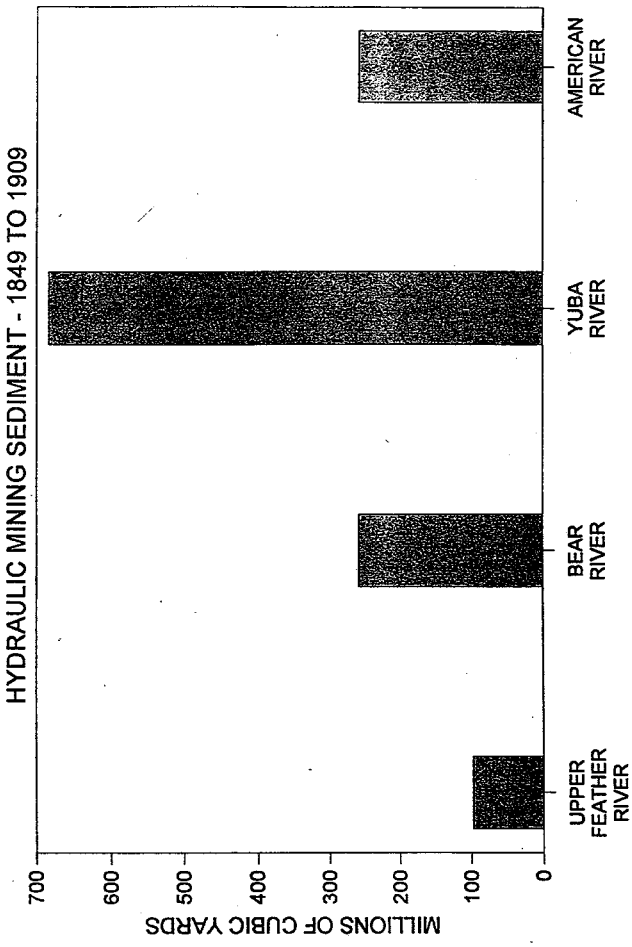


Figure IV-7 Amount of material mined on Feather, Bear, Yuba and American Rivers, 1849-1909

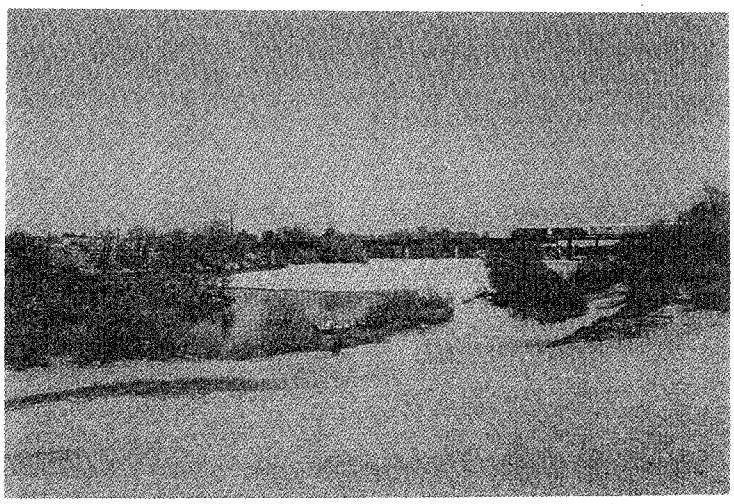


Figure IV-8. Sediment deposition at river mile 1.4 of the Yuba River.

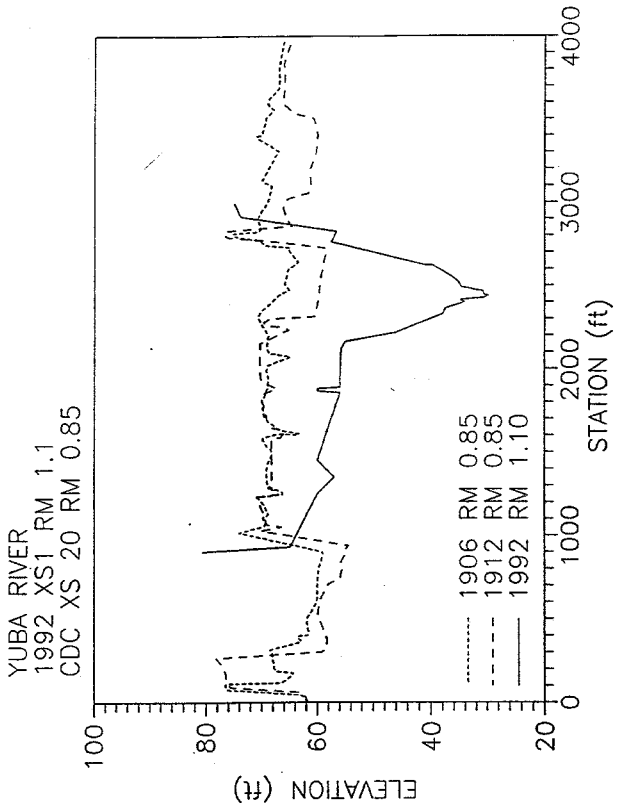


Figure IV-9 Comparative 1906, 1912, and 1992 cross sections of Yuba River at approximately RM 1.0.

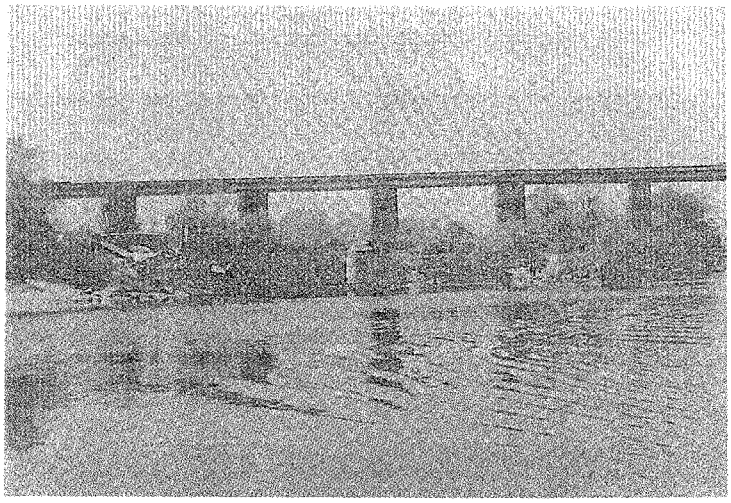


Figure IV-10. E Street bridge at river mile 1.0 on the Yuba River.

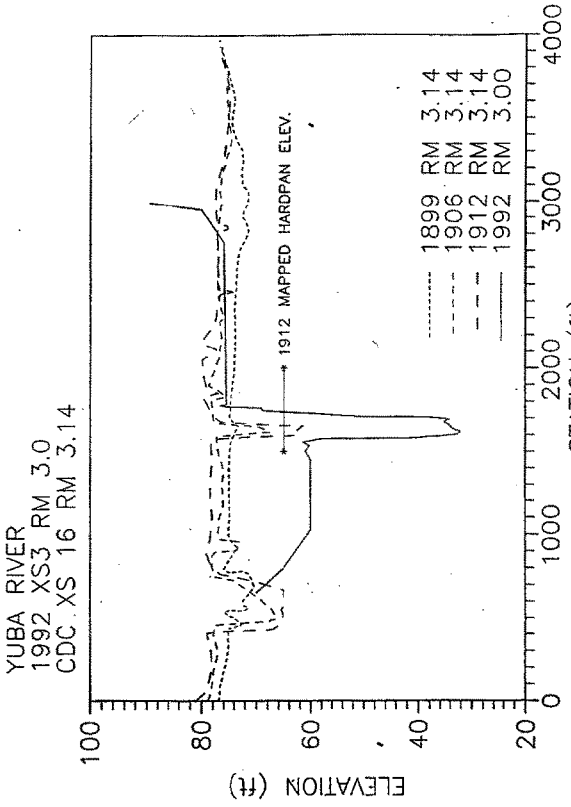


figure IV-11 Comparative 1899, 1906, 1912, and 1992 cross sections of Yuba River at approximately RM 3.1.

Figure IV-12. River mile 3 on the Yuba River.

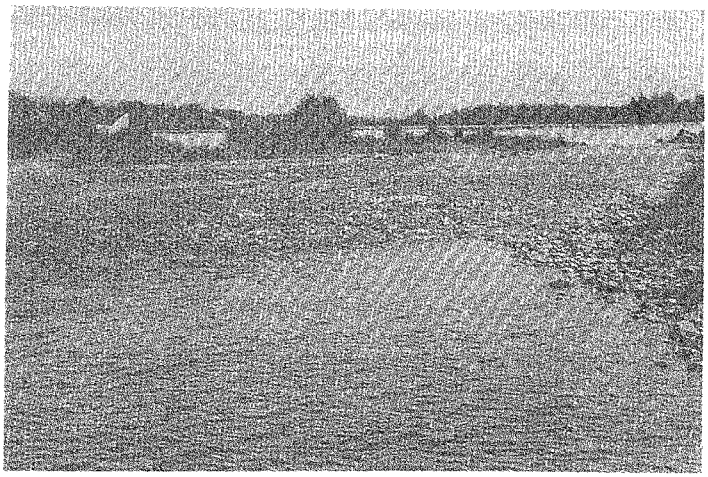


Figure IV-13. Daguerre Point Dam on the Yuba River (RM 11).

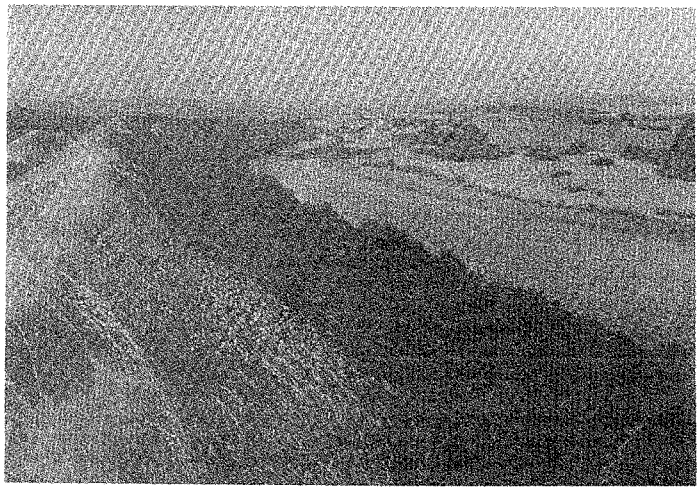


Figure IV-14. View upstream of Yuba River (RM9).

Feather River

While there has been very little bank erosion or threat to the Feather River bank or levees, the mining debris has degraded the water quality of the Feather River. The river plan view prior to 1850 was very similar to the present-day Sacramento River. Subsequent deposition due to hydraulic mining has effectively buried the pre-1850 sediments so that those deposits are not exposed either on the ground surface or within the channels banks. The Feather River is a wide, shallow, low-sinuosity sand bed river. The bed of the Feather River contains large sand waves, which were observed to be slowly migrating downstream under the relatively low-flow condition of midsummer. Consistent monitoring of the Feather River channel is critical to ensure that any destabilization is recognized early and addressed promptly. **Figure IV-15** shows cross sections of the Feather River in 1912, 1924, and 1992. **Figures IV-16 through IV-19** show views of the Feather River at RM's 16.2, 5.7, 24.8, and 12.1. The fine materials that comprised the initial sediment surge from hydraulic mining is referred to as "slickens." The slickens are thinly bedded silt, clay, and fine sand deposits which are generally low in organic content and resistant to erosion.

The addition of mining sediments into the Feather River from the Bear River is driven by flood events. During high stages, large quantities of sediment are eroded from the channel and flood plain and are delivered to the Feather River. Sedimentation has decreased on the Bear River since hydraulic mining ceased and Camp Far West Dam was completed. Reduced sediment from the Bear River in the future may increase Feather River stability problems because reduced sediment delivery would contribute to the development of an asymmetrically shaped cross section.

Numerous conclusions are discussed in the Geomorphic, Sediment Engineering, and Channel Stability Analyses Report. The most significant conclusions related to plan formulation are the following:

1. The main phase of the channel degradation due to the introduction of massive quantities of hydraulic mining sediment on the Feather River appears to have occurred by the mid-1960's. Further large-scale degradation of the river is unlikely because the base level of the channel is controlled by the sediment deposition in the lower reaches. Sediment deposition is maintained by backwater from the Sacramento River and flow loss into the Sutter Bypass.

2. The Feather River has eroded through the hydraulic mining debris into the pre-mining flood plain sediments, but as yet there has been little mass bank failure that could lead to lateral migration of the channel and threaten the stability of the levees.

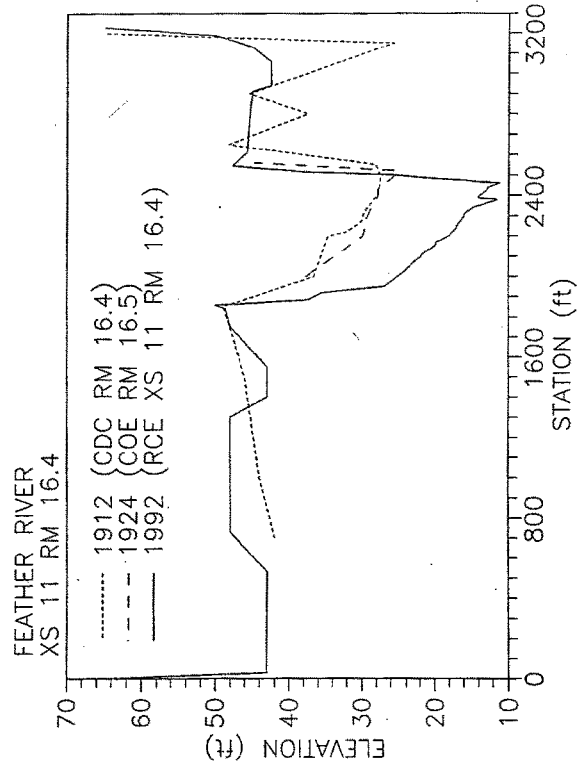


Figure IV-15 . Comparative 1912, 1924, and 1992 cross sections of Feather River at approximately RM 16.4.

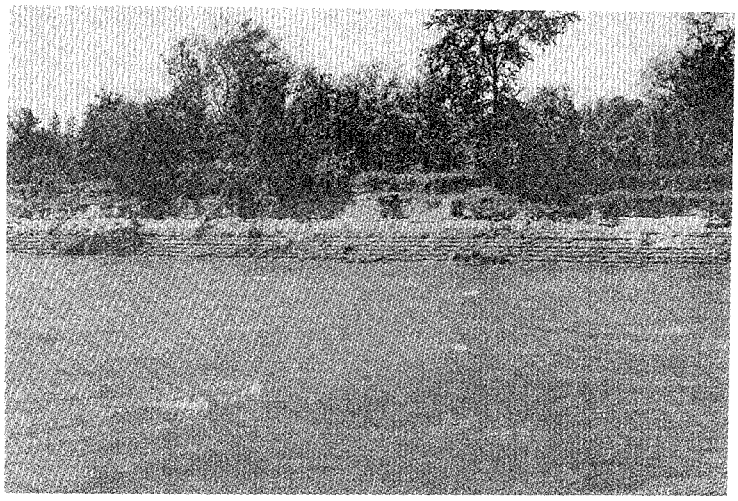


Figure IV-16. Feather River, right bank at RM 16.2.

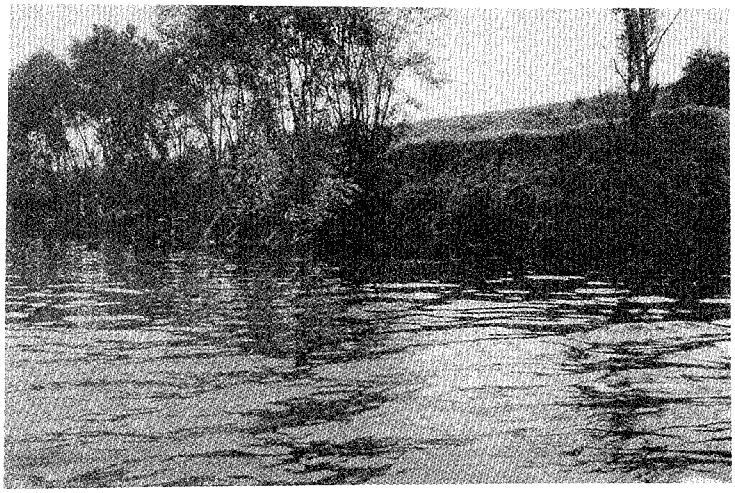


Figure IV-17. Feather River, left bank at RM 5.7.

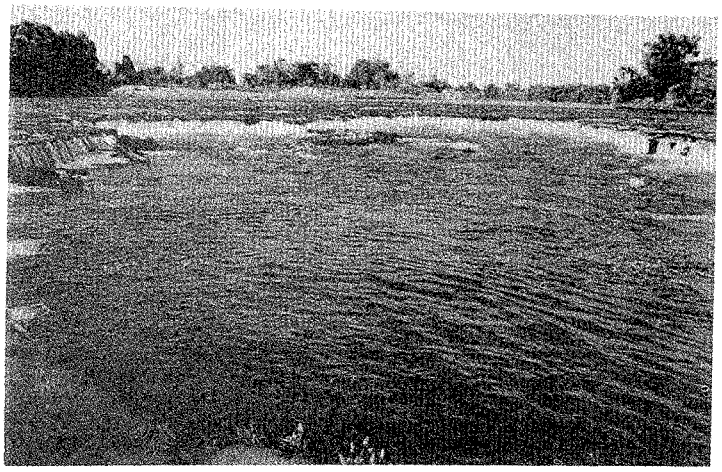


Figure IV-18. Knickpoint formed at RM 24.8 on the Feather River.

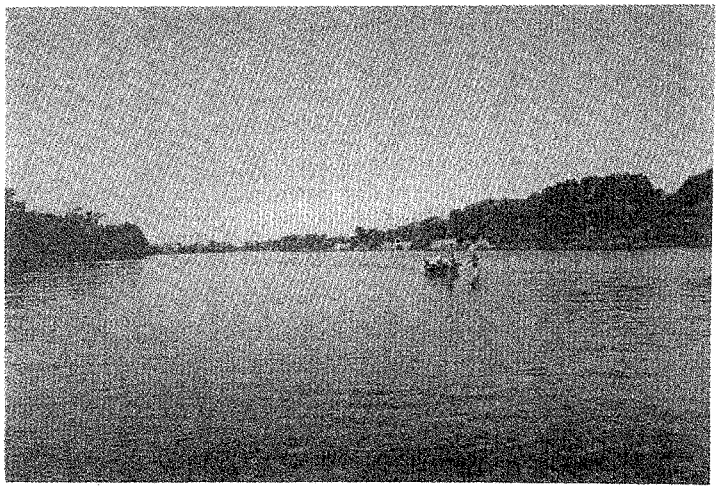


Figure IV-19. Feather River at RM 12.1 looking upstream.

3. The reason for the relative stability of the channel plan view and banks is that the sediment supply to the Feather River from the Yuba and Bear Rivers is sufficient to maintain a symmetrical cross section.

4. Field evidence indicates that backwater conditions in the lower reaches of the Yuba and Bear Rivers during floodflows cause deposition of significant quantities of sediment. Reduced downstream hydraulic control during flood recessional flows causes incision of the flood-induced sedimentary deposits in the tributaries and delivers the sediments to the Feather River. Increases in the duration of the mid-range flows on the Feather River from the placement of the dams permit the distribution of the tributary sediments downstream in the form of sand waves, thereby maintaining the symmetry of the cross section.

5. Eventual reduction in sediment delivery from both the Yuba and Bear Rivers is likely to promote cross-sectional asymmetry, and this could lead to bank erosion and lateral migration of the Feather River, which would threaten project levees. Very low sinuosity of the project reach is an anomaly for a river such as the Feather. As a result, increased sinuosity resulting from lateral migration should be expected in the future.

6. Continued erosion at Shanghai Bend (RM 24.8) would lower the base level for the upper portion of the project reach on the Feather River, which could have some serious implications for channel stability. Degradation could cause bridge stability problems in the Marysville-Yuba City area as well as cause lateral migration of the channel, which could affect the stability of the project levees.

7. Because sediment inflow from the tributaries is so important to Feather River plan view stability and the stability of the project levees, a long-term monitoring project on the two tributaries should be established. The sediment yield from the Bear River is declining. The status of the Yuba River sediment supply is uncertain and to some extent depends on the future degradation through the excavated section between about RM 2 and RM 4.5.

SURVEYS AND MAPPING

The base mapping used for this study was the U.S. Geological Survey 7.5-foot-series quadrangle maps with a scale of 1 inch equals 2,000 feet and a contour interval of 5 feet. This base mapping provides continuity for presentation of the flood plains and associated stationing of the channel and levee systems. In the overbank areas, the mapping was also used to supplement the cross-sectional data to provide flood patterns and some elevational data. During the geomorphology and sedimentation studies, 11 surveyed cross sections across the channel were added to the database.

HYDROLOGY AND HYDRAULICS

The hydrologic and hydraulic analysis was conducted to (1) determine the current level of flood protection provided by the Yuba and Feather Rivers to the study area and (2) analyze the effects of several flood control alternatives. The complete analysis is included as an attachment to **Appendix D.**

The climate and geography of the Feather and Yuba River basins combine to form an area where flooding is not unusual. Historical accounts recall large floods on the Feather and Yuba Rivers in 1839-40, 1847, 1850, 1852, 1853, 1861-62, 1867-68, 1881, 1886, and 1889-90. Prior to the completion of Oroville Dam, large flows caused levee failures and resulted in severe damages to lands in the flood plain including Marysville and Yuba City. Recorded floods occurred in 1909, 1928, 1937, 1940, 1962, and 1963. In addition, devastating floods in 1950, 1955, 1964, 1986, and 1997 caused loss of life and property damage in the study area.

The February 1986 flood was the product of an extraordinary rainfall event. Rainfall intensities approached one-half inch per hour at the peak of the storm. Heavy rains pelted the Yuba and Feather River basins between February 14 and 21. The heavy rains forced massive releases at Shasta Dam on the Sacramento River, Lake Oroville on the Feather River, and New Bullards Bar on the Yuba River, raising the water levels along the rivers. **Table IV-2** illustrates the project design flows for the Feather, Yuba, and Bear Rivers. Oroville Dam releases were maintained at 150,000 cfs, and Bullards Bar releases were increased from 20,000 cfs to 50,000 cfs, sending 93,000 cfs over Englebright Reservoir, raising the levels of the Yuba and Feather Rivers to 75.2 feet at the Fifth and E Street bridges. The Feather River gage at Gridley recorded a peak flow of about 150,000 cfs on February 19, 1986, as compared to the past Oroville Dam peak flow of 90,100 cfs on January 15, 1980. A levee break occurred on the south bank of the Yuba River on February 20 at the town of Olivehurst. Widespread flooding inundated the towns of Linda and Olivehurst. A new peak flow was recorded at the Wheatland gage on the Bear River. The new record was 48,000 cfs on February 17, 1986, as compared to the 33,000 cfs observed on December 22, 1955.

Table IV-2. Project Design Flows of the Lower Feather River

River	Reach	Flow (cfs)
Feather River		
	Oroville to Honcut	210,000
	Honcut to Yuba River	210,000
	Yuba River to Bear River	300,000
	Bear River to Sutter Bypass	320,000
Yuba River		120,000*
Bear River		40,000

* 180,000 cfs when Feather River flows are low.

Because of flow complexities, three computer programs were used to model the study area. These programs included the HEC-1 (Flood Hydrograph Package), UNET (One-Dimensional Unsteady Flow Through a Full Network of Open Channels), and HEC-5 (Simulation of Flood Control and Conservation Systems). HEC-1 was used to compute runoff from the 1986 flood for the local areas tributary to the Feather and Bear Rivers. UNET was used to model the Feather, Yuba, and Bear River system. The UNET computer program "solves" problems at river junctions and backwater areas. HEC-5 was used in computing the flow-frequency curve at Shanghai Bend and the regulated flow hydrographs on the Feather and Yuba Rivers.

Stage-frequency curves and water-surface profiles were developed for a variety of conditions. These curves and profiles were necessary to determine current levels of protection in the Marysville-Yuba City and Linda/Olivehurst area and to determine the frequency of the 1986 flood at various locations. Stage-frequency curves were developed for the Feather River near Gridley, Feather River at Yuba City, Yuba River near Marysville, and Feather River near Nicolaus. The 100-, 200-, and 400-year frequency elevations plotted on these curves reflect a flood that is specific to the Yuba River and concurrent on the Feather River. The 1986 stage plots about a 1 in 50 annual event for the Feather River near Gridley. The 1986 stage plots about a 1 in 70 annual event for the Feather River at Yuba City. The 1986 stage plots about a 1 in 30 annual event at the Yuba River near

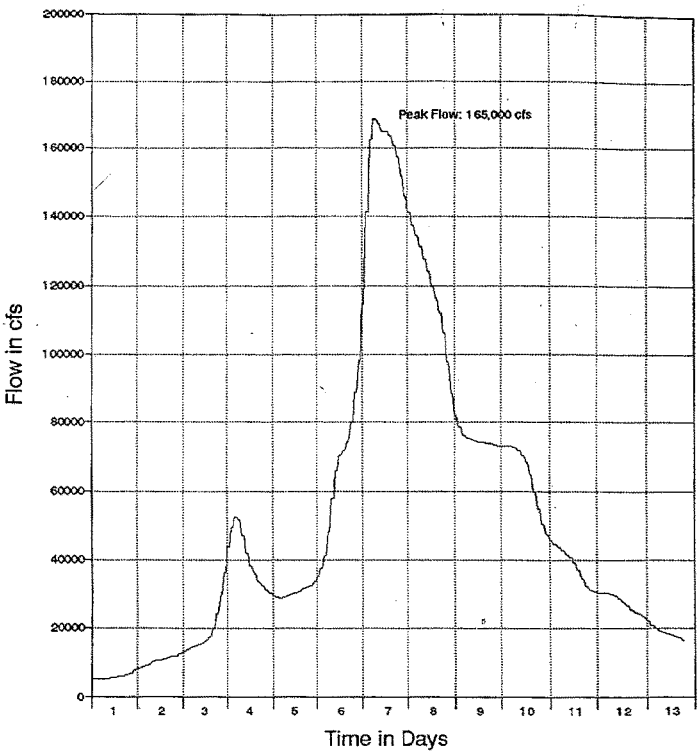
Marysville. The 1986 stage plots about a 1 in 25 annual event for the Feather River near Nicolaus. Water-surface profiles were developed for the Feather and Yuba Rivers.

Hydrologic studies were used to determine the flood hydrographs for the 1 in 100, 1 in 200, and 1 in 400 annual flood events along the Yuba and Feather River system in the Marysville/Yuba City area in order to evaluate with- and without-project conditions. To develop synthetic flood hydrographs, it is first necessary to develop unregulated rainflood volume-frequency curves. The volumes for a given frequency are then used to develop balanced synthetic flood hydrographs. Synthetic flood hydrographs were developed for the Feather River at Oroville, Yuba City, and Shanghai Bend, and for the Yuba River near Marysville for the 1986 event (see **Figures IV-20 through IV-25**).

The flood of January 1997 occurred as a result of warm moist winds from the southwest blowing over the Sierra Nevada. More than 30 inches of rain poured into watersheds that were already saturated by one of the wettest Decembers on record. The magnitude and duration of the 1997 floods affect the calculation of return periods for the Yuba and Feather River basins. The Corps used previously computed statistics to estimate the return period frequencies of the 1997 flood. Incorporating data from the 1997 flood will change some of the statistics because the statistics are over 10 years old. The resulting new statistics may change the size of flood events at all return frequencies. Incorporating the 1997 data may also increase the apparent frequency of the 1997 event. **Table IV-3** provides estimates of the 1997 peak flows, and return periods. The estimates are computed unimpaired runoff; they are preliminary and subject to change as the records from the storm are compiled and analyzed.

Table IV-3. 1997 Peak Flow and Return Period by River and Dam

River and Dam	1997 Peak Flows (cfs) and Return Period (years)	
	One day	Three days
Feather - Oroville	298,000 - 100	234,000 - 120
Yuba - New Bullards	88,000 - 75	67,000 - 120



YUBA RIVER INVESTIGATION

100-YEAR
REGULATED HYDROGRAPH
Yuba River near Marysville

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H. Date: JANUARY 1993
Drawn: J. H.

Figure IV-20

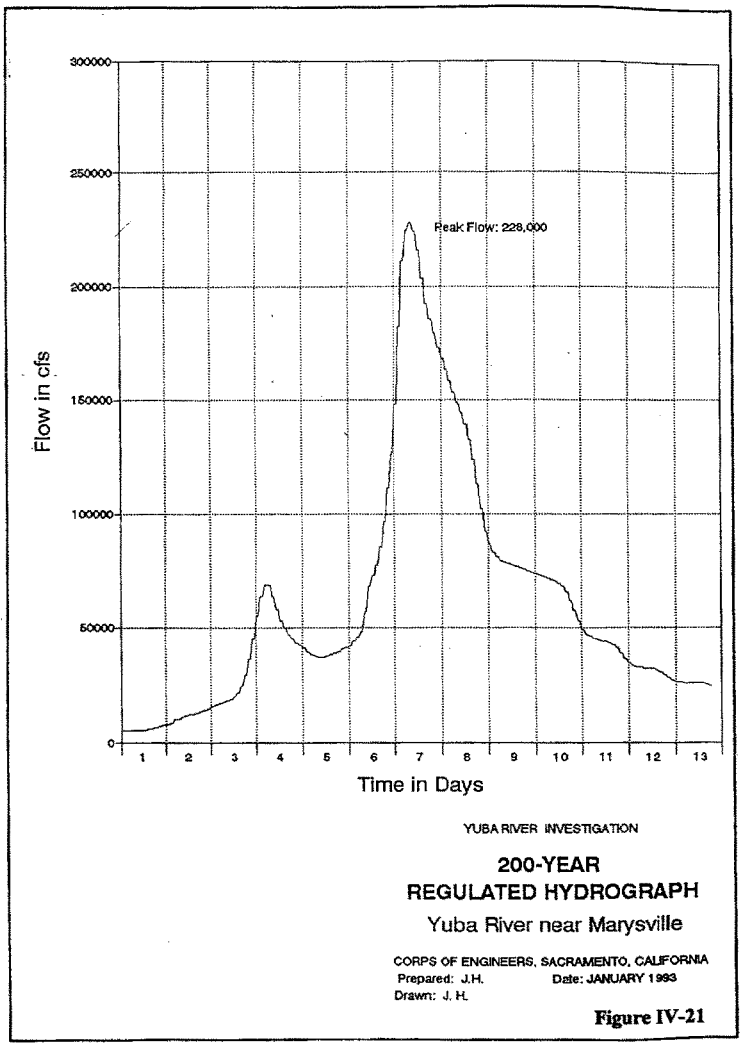
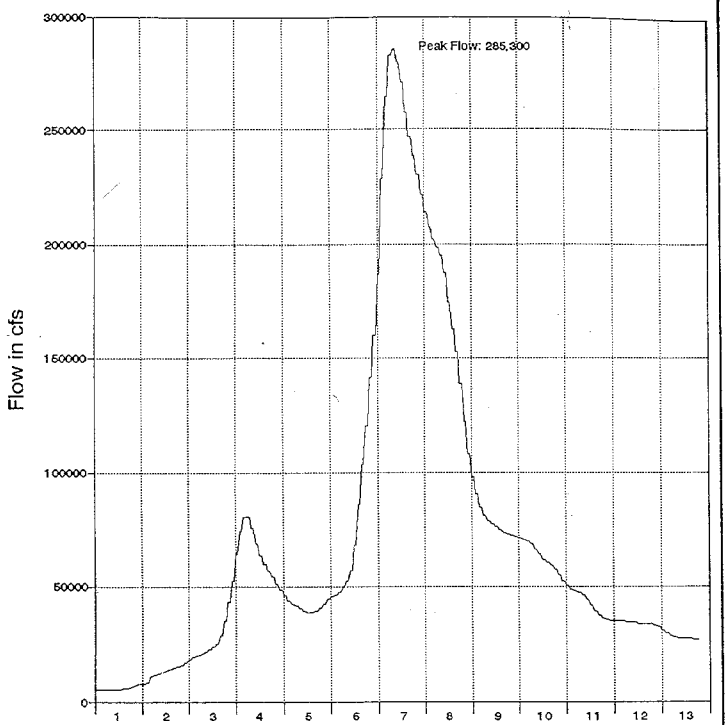

300000
250000
200000
150000
100000
50000
0
Flow in cfs
Peak Flow: 228,000
1
2
3
4
5
6
7
8
9
10
11
12
13
Time in Days
YUBA RIVER INVESTIGATION
200-YEAR
REGULATED HYDROGRAPH
Yuba River near Marysville
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H. Date: JANUARY 1993
Drawn: J. H.

Figure IV-21



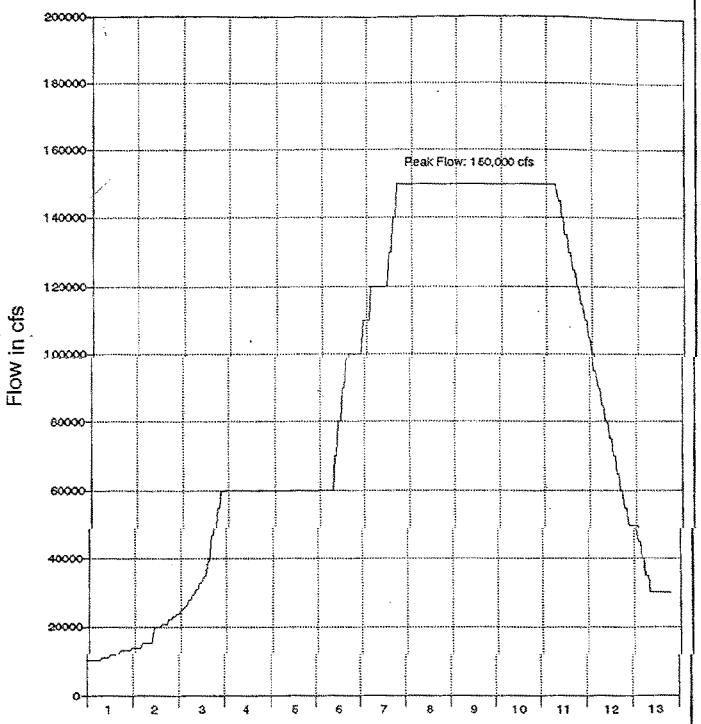
YUBA RIVER INVESTIGATION

400-YEAR
REGULATED HYDROGRAPH

Yuba River near Marysville

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H. Date: JANUARY 1993
Drawn: J. H.

Figure IV-22



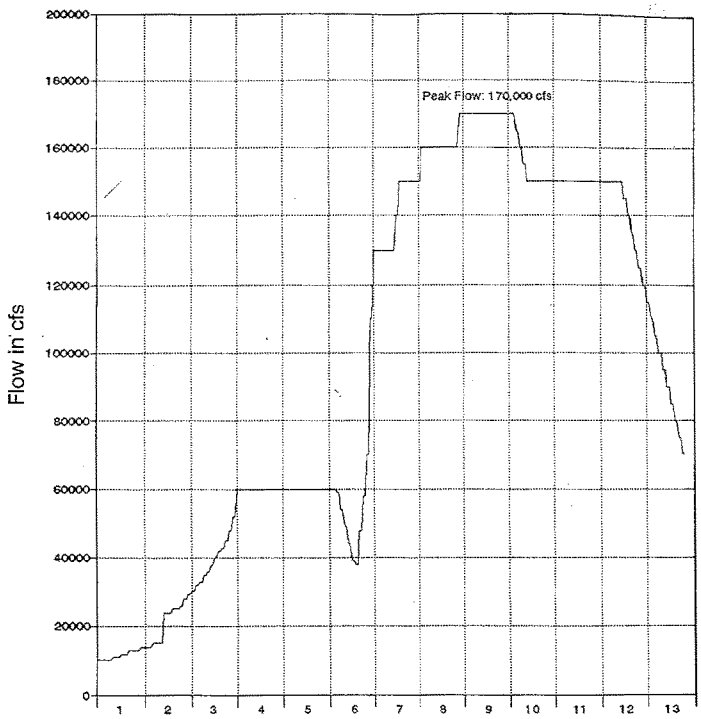
YUBA RIVER INVESTIGATION

100-YEAR REGULATEDHYDROGRAPH

Feather River at Oroville

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H. Date: JANUARY 1993
Drawn: J. H.

Figure IV-23



YUBA RIVER INVESTIGATION

200-YEAR
REGULATED HYDROGRAPH

Feather River at Oroville

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H. Date: JANUARY 1993
Drawn: J. H.

Figure IV-24

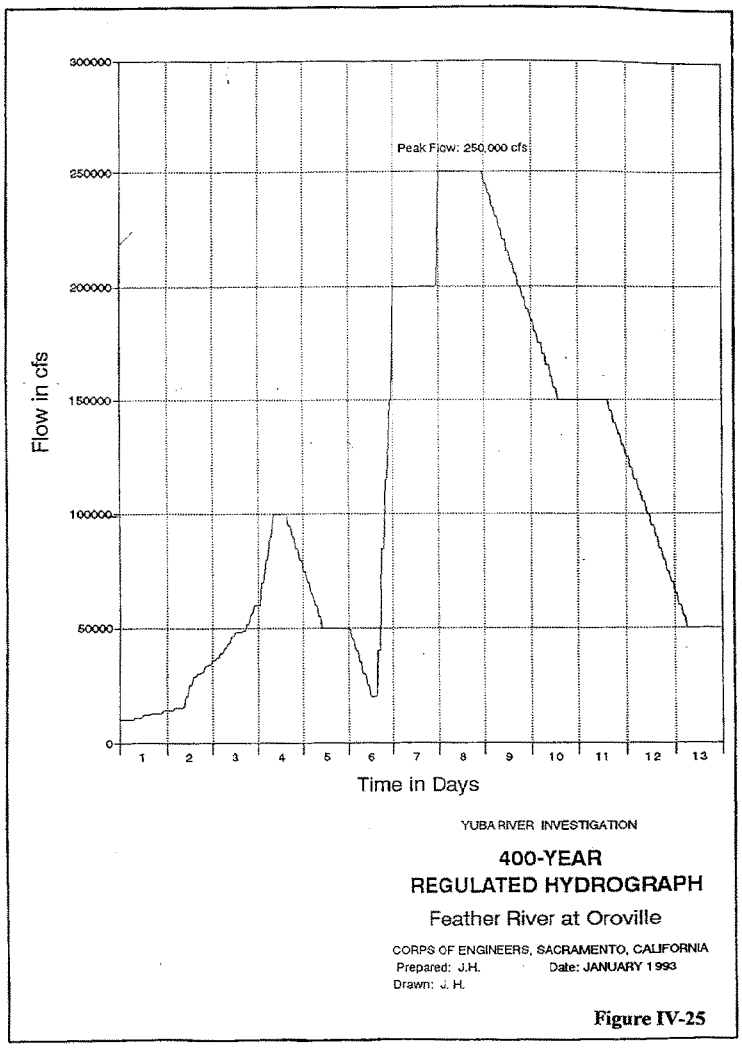

Peak Flow: 250,000 cfs
300000
250000
200000
150000
100000
50000
0
Flow in cfs
1
2
3
4
5
6
7
8
9
10
11
12
13
Time in Days
YUBA RIVER INVESTIGATION
400-YEAR
REGULATED HYDROGRAPH
Feather River at Oroville
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: J.H.
Date: JANUARY 1993
Drawn: J. H.

Figure IV-25

A levee break occurred about 6 miles south of Olivehurst on January 2, 1997, prompting the evacuation of about 15,000 people from the Yuba County communities of Olivehurst, East Linda, and West Linda. Officials estimate that about 850 homes were flooded. Nearly 50,000 inhabitants of Yuba City, Marysville, and surrounding areas were evacuated because of fears over levee breaks. The levee broke in an area scheduled for levee rehabilitation work to take place later in the year.

Although a description of the January 1997 flood is included in this report, the 1986 event is used for model calibration and hydrologic analysis. A survey comparison of the 1 in 100 and 1 in 200 annual event floods with the surveys prior to 1997 and the surveys after the 1997 floods is shown in **Figures IV-26 through IV-29.** Based upon survey data from the January 1997 flood it can be concluded that the profiles for a 1 in 100 and 1 in 200 annual event would not change significantly. The hydrology appendix includes historical flood records; description of the February 1986 flood; flow-frequency methodology for determining concurrences among the Yuba, Feather, and Bear Rivers; development of the UNET model for synthetic and existing floods; stage-frequency curves for the Yuba, Feather, and Bear Rivers; water-surface profiles; and levee failure assumptions.

FLOOD PLAIN DELINEATION

This feasibility study includes the flood plains of both the Feather and Yuba River systems as they affect the Marysville, Linda/Olivehurst, and lower RD 784 areas. The flood profiles for the 1928, 1937, 1940, 1950, and the 1955 floods have been documented and were presented with the high water profiles that established the project design water-surface profiles for the Sacramento River Flood Control Project along the Yuba River system (1957 and 1961 data). During the 1950 flood with the flow of about 75,000 cfs, the south bank of the Yuba River upstream of Daguerre Point Dam failed, resulting in extensive flooding through the Hammonton area and downstream through the Linda/Olivehurst area. Modification of the dredge tailings resulted in containment of the 1955 flood with a flow of 160,000 cfs. The 1964 flood with a flow of about 180,000 cfs was also contained within the Yuba River levee system. The 1964 and the 1986 floods both had the added benefit of reduced stages in the Feather River by Oroville Dam having been constructed. However, the 1986 flood with the peak flow of about 112,00 cfs had a levee failure during the receding side of the storm hydrograph, Reach 2 damages included actual damages from the 1997 flood event. Average annual benefits for the area were derived from actual damages from the 1997 event. The System Evaluation Levee Reconstruction work in the area of reaches 1 and 2 has been awarded. The opportunity to deepen the slurry wall for the levee reconstruction project has passed. The cost estimate in the 2nd column would have to be recalculated to include new slurry wall for the entire

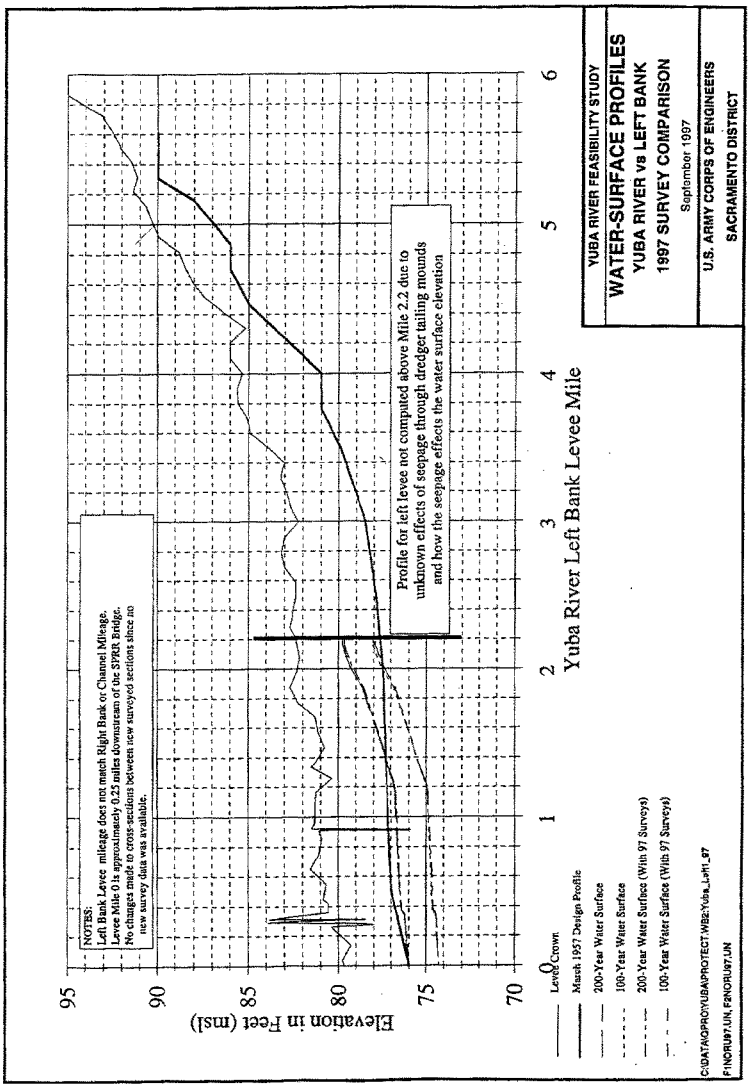

NOTES:
Left Bank Levee mileage does not match Right Bank or Channel Mileage.
Levee Mile 0 is approximately 0.25 miles downstream of the SP&R Bridge.
No changes made to cross-sections between new surveyed sections since no new survey data was available.
Profile for left levee not computed above Mile 2.2 due to unknown effects of seepage through dredger tailing mounds and how the seepage effects the water surface elevation
Elevation in Feet (msl)
95
90
85
80
75
70
0
1
2
3
4
5
6
Yuba River Left Bank Levee Mile
Levee Crown
March 1957 Design Profile
200-Year Water Surface
100-Year Water Surface
200-Year Water Surface (With 97 Surveys)
100-Year Water Surface (With 97 Surveys)
C:\DATA\OPROY\UBA\PROTECT.WBE:Yuba_Left_97
F1NORU97.UN, F2NORU97.UN
YUBA RIVER FEASIBILITY STUDY
WATER-SURFACE PROFILES
YUBA RIVER vs LEFT BANK
1997 SURVEY COMPARISON
September 1997
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure IV-26

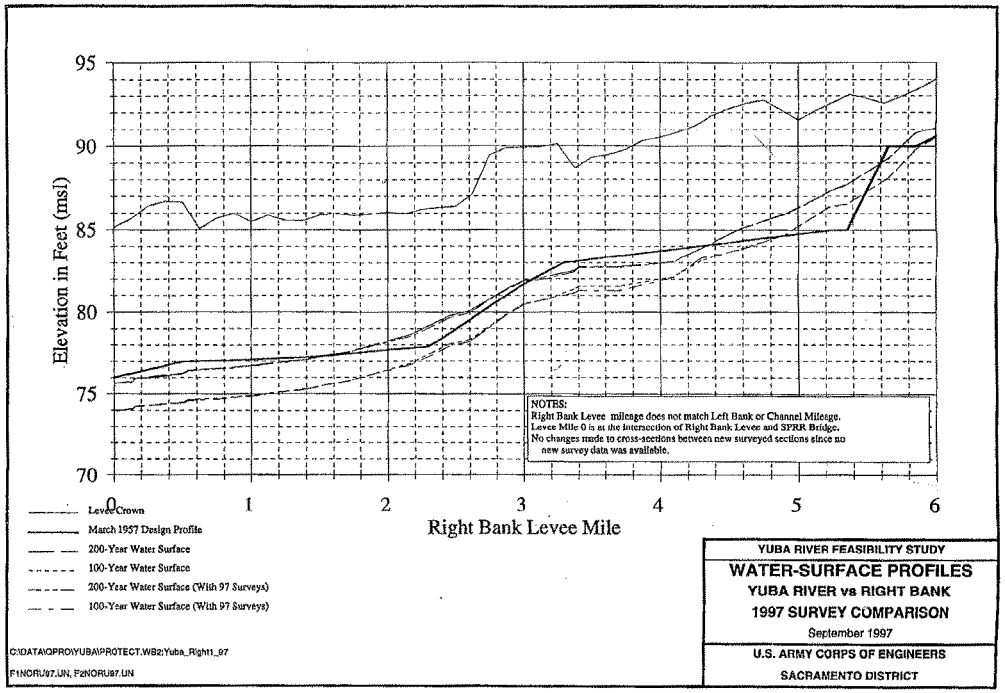

95
90
85
80
75
70
Elevation in Feet (msl)
0
1
2
3
4
5
6
Right Bank Levee Mile
NOTES:
Right Bank Levee mileage does not match Left Bank or Channel Mileage.
Levee Mile 0 is at the intersection of Right Bank Levee and SPRR Bridge.
No changes made to cross-sections between new surveyed sections since no new survey data was available.
Levee Crown
March 1957 Design Profile
200-Year Water Surface
100-Year Water Surface
200-Year Water Surface (With 97 Surveys)
100-Year Water Surface (With 97 Surveys)
C:\DATA\QPRO\YUBA\PROTECT.WB2;Yuba_Right1_97
F1NORU97.UN, F2NORU97.UN
YUBA RIVER FEASIBILITY STUDY
WATER-SURFACE PROFILES
YUBA RIVER vs RIGHT BANK
1997 SURVEY COMPARISON
September 1997
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure IV-27

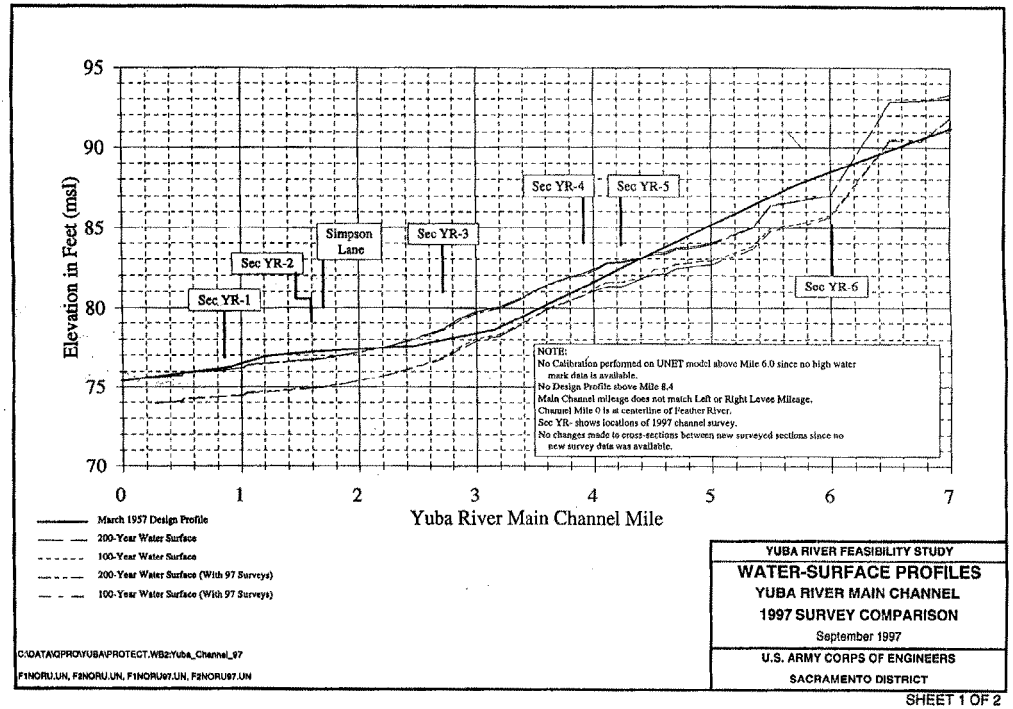

95
90
85
80
75
70
Elevation in Feet (msl)
0
1
2
3
4
5
6
7
Yuba River Main Channel Mile
Sec YR-1
Sec YR-2
Simpson Lane
Sec YR-3
Sec YR-4
Sec YR-5
Sec YR-6
NOTE:
No Calibration performed on UNET model above Mile 6.0 since no high water mark data is available.
No Design Profile above Mile 8.4
Main Channel mileage does not match Left or Right Levee Mileage.
Channel Mile 0 is at centerline of Feather River.
Sec YR- shows locations of 1997 channel survey.
No changes made to cross-sections between new surveyed sections since no new survey data was available.
March 1957 Design Profile
200-Year Water Surface
100-Year Water Surface
200-Year Water Surface (With 97 Surveys)
100-Year Water Surface (With 97 Surveys)
C:\DATA\QPRO\YUBA\PROTECT.WB2:Yuba_Channel_97
F1NORU.UN, F2NORU.UN, F1NORU97.UN, F2NORU97.UN
YUBA RIVER FEASIBILITY STUDY
WATER-SURFACE PROFILES
YUBA RIVER MAIN CHANNEL
1997 SURVEY COMPARISON
September 1997
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SHEET 1 OF 2

Figure 28

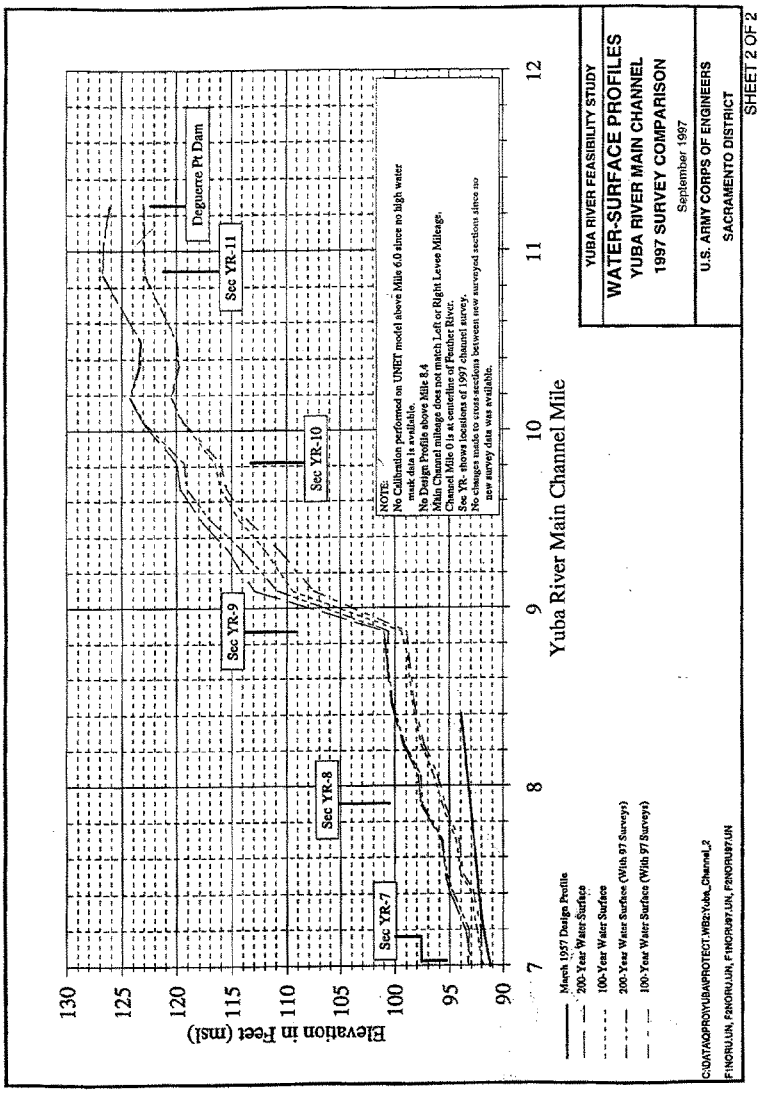

Elevation in Feet (msl)
130
125
120
115
110
105
100
95
90
7
8
9
10
11
12
Yuba River Main Channel Mile
Sec YR-7
Sec YR-8
Sec YR-9
Sec YR-10
Sec YR-11
Deguerre Pt Dam
NOTE:
No Calibration performed on UNET model above Mile 6.0 since no high water mark data is available.
No Design Profile above Mile 8.4
Main Channel mileage does not match Left or Right Levee Mileage.
Channel Mile 0 is at mouth of Feather River.
See YR- shows locations of 1997 channel survey.
No changes made to cross-sections between new surveyed sections since no new survey data was available.
March 1957 Design Profile
200-Year Water Surface
100-Year Water Surface
200-Year Water Surface (With 97 Surveys)
100-Year Water Surface (With 97 Surveys)
C:\DATA\DPROJ\YUBA\PROTECT.WB2\Yuba_Channel_2
F:\NORU.IJN, F:\NORU.IJN, F:\NORU97.IJN, F:\NORU97.IJN
YUBA RIVER FEASIBILITY STUDY
WATER-SURFACE PROFILES
YUBA RIVER MAIN CHANNEL
1997 SURVEY COMPARISON
September 1997
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SHEET 2 OF 2

Figure IV-29

depth required as in reach 3. resulting in extensive flooding in the Linda/Olivehurst area.

The flood plain study in **Appendix C** analyzes the Yuba River from its mouth on the Feather River upstream to where the river is completely contained within the foothills. This location is just under 5 miles above Daguerre Point Dam or about 16 miles from the river's mouth. The area between Daguerre Point Dam and this upstream limit has been subjected to extensive dredging. The Yuba River system is composed of four interrelated channelized areas: (1) Yuba River main channel, (2) south overflow channel, (3) north overflow channel, and (4) central overflow channel (see **Plate 6**). The study criteria assumed that flooding would be contained within the main levee system unless levee overtopping occurred. For the flows in this study, no levee reaches were identified where overtopping would occur. Therefore, the upstream study limit for this analysis was the Daguerre Point Dam. Initially, flooding for the lower reaches of the Yuba River was going to be induced by failure at the top of the levee and the resultant flood plain determined. However, this was revised to assume no failure until levee overtopping occurred. For the flows evaluated, there are no definable points of levee overtopping. As a result, the south and north boundaries for the flood plain study are the left and right banks along the Yuba River.

The Yuba River 1 in 100 annual event flood enters the dredge tailings area in a well-defined channel which contains the floodflows until Daguerre Point Dam is reached. In this vicinity, flow overtops the south bank and is routed through several ponding areas before returning to the river near RM 10.0. An insignificant amount of this overflow is lost through the dredge tailings. Overflow on the north bank occurs downstream of the dam, with most of the overflow entering the lateral river side channel just north of the main channel and a minor portion of the flow going north along the base of the foothills around the tailings until it enters the north overflow channel near Hallwood Boulevard. The flow in the lateral river side channel returns to the river near the east end of Walnut Avenue (RM 8.2). At this point, flow begins to overflow the north bank of the river into the central overflow channel. Flows exceeding the capacity of the central overflow channel flow north to the north overflow channel will return to the main channel near RM 6.3.

Yuba River channel flows will breach the north and south interior levees in the vicinity of its junction with the central overflow channel. Flows breaching the south interior levee will flow into the south overflow channel. The flows in the north overflow channel return to the river near RM 4.1 next to the landfill site. From this point downstream to just above Simpson Lane, the river continues to lose flows toward the south overflow channel. From the vicinity of Simpson Lane to the mouth of the Yuba River, the water-surface elevation is under the influence of the Feather River backwater effects; as a result, a common water-surface

elevation will occur between the south and north (left and right) levees. The flood plains for the 1 in 200 and 1 in 400 annual events for the Linda/Olivehurst area are shown on **Plate 7.** The circled letters on Plate 7 denote the economic areas.

Flood plains were analyzed for the 1 in 200 and 1 in 400 annual events for the lower RD 784 area (see **Plates 8, 9 and 10**). The Xrate model was developed to reflect the perceived floodflow path through several ridges and high ground areas, three railroad embankments, and State Highway 70 with occasional embankments. One point of failure was identified for the 1 in 200 annual event, and six points of failure (four along the Yuba River and two along the Feather River) were identified for the 1 in 400 annual event.

ENVIRONMENTAL STUDIES

The existing environmental resources in the study area were evaluated to consider the effects of the proposed alternative plans on those resources. Best management practices were developed to avoid or minimize most adverse effects. Mitigation measures for unavoidable, significant effects on vegetation, wildlife, and special status species were developed in coordination with the U.S. Fish and Wildlife Service and State Department of Fish and Game. The environmental studies are described in detail in the final EIS/EIR.

RISK-BASED ANALYSIS

Flood problems may be summarized and expressed in terms of risk. The strategy developed by the Corps for analyzing the reliability of a flood control system and later for developing and analyzing flood control alternatives calls for grouping areas with similar hydrologic, hydraulic, and economic characteristics and evaluating each area for economic feasibility. These grouped areas are referred to as study reaches.

The study area was divided into three reaches for economic analysis and plan formulation (see **Plate 11**). Reach 1 contains the cities of Linda and Olivehurst and is located south of the Yuba River and east of the Feather River. Reach 2 is the lower Reclamation District (RD) 784 area along the left bank of the Feather River from RM 21 to the Bear River. The flood plain within reach 2 is predominantly agricultural with some limited industrial development. Reach 3 consists of Marysville, which includes the entire area enclosed by the surrounding ring levee. Each area with representative frequency-flow, flow-stage, and stage-damage relationships is assigned an "index point." The index point represents the flood conditions of the index area and is often the lowest or the weakest point in a levee or where a channel is the most constrained.

One determinant in assessing risk is the strength and reliability of the flood control facility. Geotechnical analysis was used to determine if the levee is able to resist failure. This resistance to failure is expressed using the probable non-failure point (PNP) and the probable failure point (PFP). The PNP and PFP for each index point are shown on **Plate 12.** At the PNP on the levee, a flood stage would have 15 percent chance of causing the levee to fail. Typically, the PFP is higher than the PNP, and a flood stage would have an 85 percent chance of causing the levee to fail. Stronger levees would have PNP's and PFP's closer to the top. PNP's and PFP's for the study area levees are shown as an attachment to **Appendix D.**

At each index point, a series of flood elevations is generated based on the stage-frequency relationship and its calculated uncertainty. Each flood elevation is compared to the index point levee PNP and PFP. A simulated levee failure was determined for each flood elevation. (This process is called a Monte Carlo simulation.) For each water-surface elevation, levee failure was determined as follows:

- If the water surface is below the PNP, the levee is estimated not to fail.
- If the water surface is between the PNP and the PFP, the levee is estimated to fail from 15 to 85 percent of the time, depending on the relative vertical distance from the PNP and the PFP. A water-surface elevation equal to the PFP, for example, would result in an 85 percent chance of levee failure.
- If the levee is exposed to wind generated waves and if the levee has not failed as described above a geotechnically defined threshold elevation, a wind generated wave routine would then be involved. High waves can erode the top portion of a levee causing levee failure. The potential for wind generated waves to lead to levee failure is greatest when the water surface is above the threshold elevation and increases as the water surface approaches the top of the levee.

If a simulation indicates a levee failure, the resulting economic damages would be derived by comparing the simulated events and the exceedence probability. If a levee fails half the time, the exceedence probability is 0.5. The probability may also be expressed as a 1 in 2 chance of occurring in any given year, the "2" being the reciprocal of the probable exceedence.

Risk analysis also calculates the levee reliability, that is, the percent chance that a levee will hold a given event. For example, a levee may be 80 percent reliable for a 1 in a 100 annual event. For a greater event such as a 1 in 200 annual event, the same levee would be less reliable, for example, 60 percent reliable. The areas are first evaluated separately, and then the areas are combined

to develop alternatives plans. Although risk analysis can be used for levee certification, the construction of the System Evaluation work satisfies the Federal Emergency Management Agency's criteria of 3 feet of freeboard above the design water-surface elevation for the study area levees. Meeting this agency's criteria for levee certification was documented in a 10 September 1997 Memorandum from Headquarters providing guidance on levee certification for the National Flood Insurance Program.

BASIS OF DESIGN AND COST ESTIMATES

The basis of design was used to develop designs and cost estimates for various levee strengthening and raising options (see **Appendix D**). Design aspects included alignment, levee design, potential hydraulic mitigation, quantities, real estate, environmental mitigation, and operation and maintenance requirements.

Levee topography was determined from recent surveys of levee profiles and levee cross sections. The Corps and the Department of Water Resources provided profile surveys for the Yuba and Feather Rivers in 1993.

The proposed levee work would consist of raising or strengthening levees without altering the existing alignment or design of any levee reach. Geotechnical analysis and risk-based analysis assisted in the development of the design to increase the level of protection. Levee modification plans were developed to minimize seepage problems at different design levels. In identifying the design water-surface elevation and setting the probable points of failure and non-failure, the levee design had to satisfy the geotechnical requirements to meet the true exceedance. The level of protection was increased by designing the levees to convey the design flow with a high degree of reliability. The design to reduce levee and foundation seepage problems associated with the soil characteristics in the study area included a combination of toe drain and berms or a slurry cutoff wall through the crown of the levee. Design considerations included modifications and/or extensions to the System Evaluation since the work had not been constructed and the opportunity existed to include features to the project that would provide increased flood protection.

A detailed cost estimate was developed for the national economic development (NED) plan in October 1996. A more detailed cost estimate (MCACES) was prepared for the Recommended plan. Project first costs were developed based on October 1997 price levels. Annual costs were based on a 50-year project life and a 7-1/8 percent interest rate. Operation and maintenance costs were also developed.

ECONOMICS

An economic analysis was performed to calculate without-project damages and flood control benefits of the various alternatives (see **Appendix B**). Flood damages were computed by determining relationships between damage and flood depths, flows, and frequencies. Physical damages were determined for several categories: industrial, commercial, residential, public, agricultural, and auto. In addition, emergency costs during flood emergencies were determined for evacuation and reoccupation, flood fighting, disaster relief, and extra duty police, fire, and military protection.

Physical damages include loss and destruction due to flooding in each category.

- Industrial facilities use raw materials and manufacture or fabricate commodities. Industrial properties consist of fixtures and equipment, inventory, and structures.

- Commercial damages were computed by using structural value and content value, which includes equipment and furniture, supplies, merchandise, and other items used in conducting business.

- Residential damages consist of physical damages to dwellings (single-family, multiple-family, and mobile homes) and damages to residential contents including household items and personal property. Based on discussions with local insurance agents, the value of contents is equal to 50 percent of the replacement cost of the structure. Benefits were not estimated for the projected increase in household content (affluence).

- Public damages are the tangible damages of flooding to hospitals, churches, libraries, schools, government facilities (including equipment and furnishings), parks, roads, bridges, and highway structures.

- Agricultural damages to crops were considered in the analysis because farming is a major land use in the Linda/Olivehurst and RD 784 areas.

- Auto damages were based on an estimate of the number of automobiles in each flood plain hazard zone.

Flood plain structures in reaches 1 and 3 were inventoried in 1996. Reach 2 was inventoried in April 1997. The inventory involved (1) estimating the number and size of physical units within the flood plain and (2) assessing existing and future replacement costs of the units. Field surveys, aerial photos, and data analysis were used to determine the number, size, and foundation heights of

structures for each flood hazard zone (1 in 100 and 1 in 400 annual events) for each land-use category. The flood plain for the 1 in 400 annual event contains about 6,033 structures in reach 1,807 structures in reach 2, and 5,519 structures in reach 3.

Land uses within the flood plain are residential (single-family, multiple-family, and mobile homes), commercial, industrial, public, and agriculture. The replacement costs for existing properties were determined from various sources including the Yuba County Assessors officials, discussion with local realtors, and the Yuba County Assessors Rolls. The replacement costs for structure contents were estimated as a percent of structure value for residential, commercial, and public structures. The replacement costs for industrial structures and contents were determined from personal interviews.

Depth-damage relationships describe the probable damages that would occur under different depths of flooding as a percentage of the total value of damageable property. The Federal Insurance Administration's 1988 depth damage relationships were used for residential and public structures.

Damage-flow relationships describe the probable damages expected at various flow-frequencies. These relationships are derived by estimating the probable flood damages of several hypothetical floods. Intermediate damage points are interpolated from these estimates by using standard mathematical integration techniques. The probable flood damages that would result from a particular flow are estimated by describing the flood plain area associated with flooding and then applying the appropriate depth-damage relationships. Probable damages were determined for the 1 in 100 and 1 in 400 annual events.

Average annual damages are the expected value of damages for a given economic condition and point in time. They are determined by weighing the estimated occurrence and may be approximated by measuring the area under the damage-frequency curve using standard mathematical integration procedures. The average annual equivalent flood damages of about $3,187,000 in the Linda/Olivehurst area, $518,000 in the lower RD 784 area, and $4,727,000 in the Marysville area were estimated for the NED analysis (discussed in Chapter V) at October 1996 price levels.

REAL ESTATE

A gross appraisal real estate estimate was prepared for the recommended plan. An analysis was conducted to determine if hydraulic effects resulted in a "taking" within the meaning of the 5th Amendment of the United States Constitution. Generally, a taking occurs when there is either a physical appropriation of private property or a substantial interference with the property which destroys or lessens its value. Costs were estimated at October 1997 price levels. All lands needed for the project, regardless of ownership, have been estimated at fair market value. The baseline cost estimates for the flood control alternatives include acquisition and administrative costs. The Federal costs of monitoring the acquisitions, certifying for construction, and crediting the non-Federal sponsor were estimated by the Sacramento District Real Estate Division. The real estate report is included as **Appendix A.**

CHAPTER V - PLAN FORMULATION

In accordance with Federal Water Resources Council's Principles and Guidelines, plan formulation is the process of developing and evaluating alternative plans to meet the needs and desires of society, as expressed in specific planning objectives, and selecting the plan that best satisfies the objectives. During plan formulation for the Yuba River Basin Investigation, the following procedures were used to formulate and select a plan to be recommended for implementation:

- Establish specific planning objectives
- Define constraints and criteria for formulating an implementable plan
- Identify the alternative that maximizes NED benefits
- Compare and evaluate the alternatives and select a plan to be recommended for implementation

PLANNING OBJECTIVES

Planning objectives served as guidelines for formulating and evaluating plans to address the problems and realize the opportunities in the study area. These objectives were to (1) reduce potential flood damages along the Yuba and Feather Rivers in the urban areas of Marysville, Linda, and Olivehurst, (2) preserve the study area's environmental and cultural resources, and (3) develop the selected plan in accordance with the Federal objective of water and related land resource planning, including features that contribute to national economic development and are consistent with environmental statutes, Executive Orders, and other Federal planning requirements for protecting the Nation's environment.

FORMULATION AND EVALUATION CRITERIA

The following criteria relate to the problems and opportunities in the study area and provide the basis for objectively and consistently evaluating the alternatives.

Technical Criteria

- Plans will be consistent with local city and county general plans and with the provisions of the National Flood Insurance Program.
- The selected plan will not (1) significantly affect preproject conditions for floods exceeding project design without determining if compensation

measures are required and (2) significantly aggravate preproject flood hazards for downstream developments without compensating for the effects.

Economic Criteria

- To the extent possible, benefits will be expressed in comparable terms, and evaluation of alternatives based on the same price level, interest rate, and project life.
- Each alternative will be justified in the sense that total benefits associated with the objectives are equal to or exceed total adverse effects associated with the objectives.
- Project benefits will be based on analysis of conditions with and without a project.
- The selected plan will be the NED plan, which maximizes economic benefits over project costs, unless there are significant reasons to select an alternative plan.

Environmental Criteria

- Plans will be formulated to preserve, mitigate the quality of the natural environment, and to the extent practical, preserve, restore, and enhance significant resources including fish and wildlife, vegetation, land, air, water, open space, and esthetic values.
- Mitigation for unavoidable environmental effects will be developed including strategies to avoid effects and replace resources and should be based on an incremental analysis methodology.
- The relationship of the proposed action to land use plans will be considered; the environmental effects of proposed actions evaluated; any unavoidable adverse environmental effects delineated; alternatives to such proposed action identified; the relationship between local short-term uses and the maintenance or enhancement of any long-term productivity determined; and any irreversible and irretrievable commitments of resources involved in project implementation identified.
- The evaluation and preservation of historical, archeological, and other cultural resources will be considered.

Social Criteria

- Safety, health, community cohesion, and social well-being will be considered, the improvement of leisure activities and public facilities evaluated, and the displacement of people minimized to the extent practicable.

- Project effects on the income, employment, business, and industrial activities, population distribution, and desirable community growth will be considered.

- General public acceptance of alternative plans will be determined through public meetings, field inspections, informal meetings, letters, and other public involvement procedures.

PLANNING CONSTRAINTS AND CRITERIA

Plan formulation constraints for this study include congressional direction and current applicable laws, regulations, and policies affecting the study area. In addition, the Planning Principles and Guidelines define specific criteria that are applicable to the development of alternatives and plan selection for all Federal water projects. These criteria are:

- Completeness, or the extent to which an alternative provides and accounts for the investments and actions necessary to ensure that planned effects are realized.

- Effectiveness, or the extent to which an alternative alleviates specified problems and achieves the specified objectives.

- Efficiency, or the extent to which an alternative plan is the most cost-effective means of alleviating specified problems and realizing opportunities, consistent with protecting the Nation's environment.

- Acceptability, or the workability of an alternative with respect to acceptance by the public and state and local entities and its compatibility with existing laws, regulations, and public policies.

PERIOD OF ANALYSIS

The period of analysis for this study was considered to be 50 years from 2002 to 2052 and did not include the time required for project implementation. Although the actual base year, or the time the project would be on line and

operational, would depend on congressional authorization and funding, the economic analysis assumed a base year of 2002.

FLOOD CONTROL MEASURES

A variety of measures to help increase the level of flood protection in the Yuba River basin were identified by the Corps, non-Federal sponsor, and other interested organizations and individuals.

Modify Levees

The purpose of modifying existing levees is to protect areas on the land side of the levees from flood inundation and to better transport floodwater through the flood control project without causing damage. Increasing levee heights to provide higher levels of flood protection was analyzed, as well as the addition of berms and toe drains to further strengthen the levees.

Nonstructural Measures

Most structural flood damage reduction measures are directed at the source of flooding. Their purpose is to change the direction of floodflows, decrease the area of inundation, alter the timing of floodflows, or store floodflows. In contrast, most nonstructural measures are directed at flood damage reduction of individual property through the use of land use restrictions and other actions. Nonstructural measures fall into these broad categories:

- Flood proofing includes temporary or permanent closure of structures, raising existing structures, and constructing small walls or levees around structures.

- Flood plain evacuation involves either moving the structure and its contents to a flood-free site, or removing only the contents and demolishing the structure or using it for some other purpose.

- Development restrictions include zoning, subdivision regulations, and modification of building and housing codes to require that all future development is compatible with the flood threat.

- Flood warning consists of flood forecasting; warning the population; evacuation before, during, and after a flood; and post-flood reoccupation and recovery. Those procedures are currently in force under a coordinated plan involving Federal, State, and community governments.

Nonstructural measures that were considered included relocating or elevating individual or groups of structures, flood plain zoning, flood warning systems, and preparedness planning.

Diversion Facilities

Diversion facilities move floodwaters from one segment of a river or bypass system to another. Diversions can be accomplished by pumps, overflow weirs, or other diversion facilities. Diversions, alone, cannot store the volume of water necessary to provide high levels of flood protection. Diversions, as part of a multipurpose project, could provide an increment to the overall flood control objective by reducing the peak flow of the Yuba or Feather River.

New Upstream Storage

Construction of new upstream dams and reservoirs, whether single-purpose for flood control or multipurpose of flood control, hydropower, water supply, and recreation, could provide high levels of protection. Preliminary studies indicated that a new upstream dam and reservoir to provide the level of protection needed on the Yuba River would be more effective with a mainstem location. An upstream reservoir could reduce flooding to the capacity of existing levees on the Yuba and Feather Rivers, if operated in conjunction with the New Bullards Bar and Oroville projects. When a major storm is centered on either the Feather or Yuba River, the project with the greatest space available for flood control could regulate outflows to minimum levels while the other projects make maximum releases. Upstream storage could reduce seepage and erosion of the existing levee system during high flows and reduce the chances of downstream levee failure. During normal flows, however, a new storage project below Englebright Dam could resu in channel stability problems downstream in the Yuba or Feather Rivers. The reservoir would trap sediments that would normally move into the river channels, thus upsetting the erosion/deposition process. As a result, erosion could actually increase downstream.

Deepen or Enlarge Channels

Channel deepening or enlargement through dredging, removing flow constrictions, or setting back levees allows greater volumes of floodwater to pass through a system. Dredging the Yuba or Feather Rivers was not considered because of the uncertainties involved in determining the effect of dredging the rivers and conducting future maintenance dredging. In addition, because of the potential for catastrophic flood damages and loss of life, a permanent solution was considered to be necessary.

Raise Dams and Reservoirs

Raising the height of existing dams could allow additional storage space for flood control purposes. The major existing dams in the study area are the Oroville Dam on the Feather River, New Bullards Bar Dam on the north fork of the Yuba River, and Englebright Dam on the mainstem of the Yuba River. Other reservoirs in the study area include Merle Collins, Camp Far West, Clementine, Spaulding, Thermalito Afterbay, and Thermalito Forebay. Raising the height of a dam or the level of a reservoir would require 240,000 acre-feet of storage to meet flood control requirements for the Marysville/Yuba City area. Increasing storage capacity could increase flood control storage and reduce urban flood damages to downstream urban areas. Increasing the height of Englebright Dam to the maximum elevation without adversely affecting the New Colgate Powerplant would not provide the flood control storage needed to control the standard project flood.

Reregulate Reservoirs

Current operations of Oroville, New Bullards Bar, and Englebright Reservoirs affect downstream flows in the Yuba and Feather Rivers. Changing the operation of one or more of these reservoirs by allocating more storage space for flood control could reduce flooding and flood damages in downstream areas. However, such a change would be accomplished by reducing the allocated storage space, and thus benefits, for water supply, hydropower, and/or recreation. Such tradeoffs may or may not be acceptable to other Federal and State agencies and local interests.

PRELIMINARY ALTERNATIVE PLANS

No Action

For the no-action alternative, there would be no Federal participation in flood control improvements in the study area. Also, the same assumptions used for the without-project condition would be applied to the no-action alternative. This no-action alternative assumes that the work proposed in the System Evaluation is completed. Once the System Evaluation work is in place, the project levees will meet the Federal Emergency Management Agency's levee certification requirements for protection from the 1 in 100 annual event. Also, the no-action alternative assumes that the authorized Marysville Lake project would not be constructed.

Modify Existing Levees

Several types of levee modifications were analyzed: raising existing levees, floodwalls, cutoff or slurry walls, and cross levees.

- Setback levees currently make up the levee system in the study area. Raising these existing levees would allow greater volumes of floodwater to pass through the system without causing damage, thus increasing the level of flood protection to the study area. Preliminary studies indicated that this measure was feasible, and it was considered in the development of alternative plans.

- Floodwalls would be more aesthetically objectionable than grass-covered earth embankments. Also, the construction of floodwalls is more expensive than placing additional embankment. For these reasons, raising existing levees was determined to be more economically feasible than constructing floodwalls on top of levees.

- Cutoff or slurry walls are used to reduce or eliminate seepage through a levee. Seepage can create stability problems and cause a levee to fail. Seepage problems in this area have been identified, and cutoff walls or slurry walls are included in Phase II of the System Evaluation. Since this measure addresses the seepage problem, cutoff or slurry walls were retained for further analysis.

- Since Marysville is protected by a ring levee, construction of a cross levee would not be feasible. The effectiveness of cross levees to protect the urbanized areas in reaches 1 and 2 was also evaluated. However, no feasible locations in the Linda/Olivehurst and lower RD 784 areas where the construction of cross levees would protect only urbanized areas were identified. Consequently, cross levees were not considered a feasible means of achieving increased flood protection in the study area.

Nonstructural Measures

Nonstructural measures were considered as a preliminary plan in accordance with Corps' regulations, which require that a nonstructural plan be included in a full array of alternatives. However, because of the large flood plain, large numbers of residential, commercial, industrial, and institutional structures in the flood plain, and high flood depths, raising structures or removing them from the flood plain would not be economically feasible. Similarly, flood-proofing measures such as constructing small walls or levees around structures would not be economically or socially feasible. Increased efforts in flood plain evacuation and local flood warning systems are currently being pursued in the study area by local and State

agencies. Consequently, these nonstructural measures were not formulated into a final alternative.

Large or Small Bypass

Large and small bypasses were considered to divert water between Hammonton and Daguerre Point Dam and convey the water down Reeds Creek to the Western Pacific Bypass to the Bear River, which empties into the Feather River. Reevaluation of the technical and economic analyses indicated that based on updated costs and benefits, neither size of bypass would be economically feasible. As a result, this alternative was not considered further.

Reregulate Oroville and New Bullards Bar Reservoirs

The potential to reserve more flood storage space at Oroville Reservoir (750,000 acre-feet) and Bullards Bar Reservoir (170,000 acre-feet) was evaluated. Reregulating these two reservoirs on the Feather and Yuba Rivers, respectively, would still leave the Middle Yuba River, South Yuba River, and Deer Creek unregulated for flood control. Increasing flood control storage in Oroville and New Bullards Bar Reservoirs would have an adverse effect on water supply yield and hydroelectric power generation and would probably not achieve high levels of flood protection. This alternative would require extensive study, cooperation, and negotiation by Federal, State, and local interests. Local interests do not support the efforts to increase the flood control space allocation in these reservoirs. As a result, this alternative was not considered further.

Raise Englebright Dam and Reregulate Englebright and Bullards Bar Reservoirs

Raising Englebright Dam to provide flood control storage and decreasing releases in conjunction with reregulation of New Bullards Bar Reservoir was considered. Preliminary seismic and economic studies indicated that raising the dam was not economically feasible. A reevaluation of the costs of raising the Englebright Dam and reregulating New Bullards Bar Reservoir showed that the alternative remains economically infeasible. Since this alternative did not meet the objectives of the non-Federal sponsor and was not cost effective, it was not considered further.

Reregulate Englebright Dam

The reconnaissance study recommended further study of reregulating Englebright Dam to provide flood control. However, reregulating this reservoir was eliminated as an alternative prior to initiation of the feasibility study. It was determined that reregulating Englebright Reservoir would adversely affect

recreation, water supply yield, and hydropower generation and would not provide adequate levels of flood protection in the study area.

Parks Bar Single-Purpose Reservoir

An estimated 200,000 acre-feet of storage at the Parks Bar Site would be necessary to provide a standard project flood level of protection to downstream areas. In order to provide protection from a 1 in 200 annual event, an estimated 100,000 acre-feet would be required. For this investigation, 180,000 acre-feet was used to determine the necessary reservoir size for uncertainties in reservoir release control. Single-purpose dam sites were examined on the mainstem of the Yuba River, in particular at the Afterbay, Long Bar, and Parks Bar damsites. Consideration of the Afterbay and Long Bar sites was discontinued due to the high costs of relocating the State Highway 20 bridge and roadway, dewatering problems, and extensive diking requirements. The lack of economic feasibility of a single-purpose reservoir at the Park Bar site precluded it from further consideration.

Parks Bar and Narrows Multipurpose Reservoir

Small and large multipurpose reservoirs were considered on the Yuba and South Yuba Rivers. Sites for small reservoirs included Afterbay, Long Bar, Parks Bar, Timbuctoo Bend, and the Narrows on the Yuba River. Large reservoirs were examined at Parks Bar and the Narrows on the Yuba River and Edwards Crossing on the South Yuba River. Preliminary technical analyses indicated that development of flood control at all of the damsites was infeasible except Parks Bar and the Narrows. Subsequent economic analyses of multipurpose reservoirs for flood control at Parks Bar and the Narrows sites indicated that neither was economically feasible. Reevaluations of the costs for multipurpose reservoirs at the Parks Bar and Narrow sites indicated that there was no significant change in benefits to support the increase in cost of the project due to rate of inflation. Therefore, the lack of economic feasibility precluded this alternative from further consideration.

FINAL ALTERNATIVE PLANS

Based on the evaluation of the preliminary alternatives, the no-action plan and levee modification plans were evaluated in greater detail. Based on the risk-based analysis, new levee work to provide increased levels of flood protection after completion of the Phase II project was not economically feasible. Only additional levee modification work constructed in conjunction with the Phase II work would be economically feasible.

No Action

Under this plan, the Federal Government would take no action to implement a flood control project in the study area. Future population trends, land use, and related urban growth would continue to be generally as described in current local plans. The average annual equivalent flood damages of about $3,187,000 in the Linda/Olivehurst area, $518,000 in the lower RD 784 area, and $4,727,000 in the Marysville area would continue.

Development of Levee Modification Plan

The most economically efficient and technically feasible flood control plan consisted of improvements to the existing levee system. These improvements included a combination of slurry walls and berm and toe drains. To establish the most cost effective level of protection, a series of design and cost estimates was developed for a range of PNP levels for each of the three reaches.

All proposed modifications are considered to be extensions and/or additions to the reconstruction work approved under Phase II of the System Evaluation. The proposed modifications would, where necessary, consider construction at the same time as the ongoing reconstruction work to avoid added costs associated with the duplication of materials if such work were done separately. Since work was identified to be constructed in conjunction with the System Evaluation work, the non-Federal sponsor pursued constructing this advanced work during the levee reconstruction project. All advanced levee work was considered to be part of the alternative costs. Advanced work is discussed further in Chapter VI.

Costs and benefits were calculated for a range of PNP design levels from the 1 in 100 annual event to the 1 in 300 annual event. The design and cost estimates for the various PNP levels were based on added construction work to the System Evaluation. Each reach was examined separately to determine the costs and benefits for each PNP level. The level that resulted in the greatest net benefits was identified as the NED plan.

Linda/Olivehurst Plan (Reach 1). Levee improvement design and cost estimates were developed for a range of PNP levels for reach 1. The PNP elevations would range from 80.5 to 83.5 feet. The PNP for the assumed baseline condition (System Evaluation work in place) was 78.0 feet. Each design involved added construction work to the System Evaluation in common areas, consisting of deepening slurry walls, deepening or widening toe drains, and widening berms. Levee raising was required for PNP elevations in excess of 81.6 feet. The improvements would be implemented in conjunction with the System Evaluation. Hydraulic mitigation for PNP design elevations of 80.5 and 81.6 feet would not be

required along the Feather River at Yuba City since the hydraulic effects range from 0.005 foot to less than 0.2 foot.

Lower RD 784 Plan (Reach 2). Levee improvement design and cost estimates were developed for reach 2. The PNP elevations for this reach would range from 63.0 to 65.2 feet. Similar to reach 1, the lower RD 784 levee designs involved adding construction work to the System Evaluation in common areas consisting of deepening slurry walls, deepening or widening toe drains, and widening berms.

Marysville Area Plan (Reach 3). Levee improvement designs and cost estimates were developed for reach 3 for PNP levels ranging from 77.0 to 82.0 feet. The improvement work consists of new slurry walls, toe drains, and widening existing berms. Construction for this reach would take place on the waterside of the levee because of the close proximity of structures on the Marysville side of the levee.

Table V-1 shows the plan formulation analysis for design and cost estimates and benefits of various PNP elevations in each reach. In reach 1, benefits were maximized at a PNP elevation of 83.0 feet. This design had a first cost of $16 million, average annual costs of $1.5 million, average annual benefits of $2.3 million, a benefit-to-cost ratio of 1.5, and net benefits of $800,000. In reach 2,

Table V-1. Summary of Costs and Benefits for Plans

Annual Event/ PNP (ft)	First Investment Costs $million	Average Annual Costs $1,000	Average Annual Benefits $1,000	Benefit/ Cost Ratio	Net Benefits $1,000
Reach 1 - Linda/ Olivehurst					
1 in 63/ 78.0	0.00	0.00	0.00	-	-
1 in 100/ 80.5	9.0	800	1,200	1.5	400
1 in 150/ 81.6	12.3	1,100	1,700	1.5	600
1 in 200/ 82.5	16.0	1,400	2,100	1.5	700
1 in 250/ 83.0	18.0	1,500	2,300	1.5	800
1 in 300/ 83.5	20.0	1,800	2,400	1.3	600
Reach 2 - lower RD 784					
1 in 111/ 62.0	0.00	0.00	0.00	-	-
1 in 150/ 63.0	1.5	120	160	1.3	40
1 in 200/ 64.5	2.7	200	280	1.4	80
1 in 300/ 65.2	3.6	290	340	1.2	50
Reach 3 - Marysville					
1 in 114/ 77.0	0.00	0.00	0.00	-	-
1 in 150/ 80.0	17.0	1,200	1,500	1.3	300
1 in 200/ 81.0	17.5	1,370	2,400	1.8	1,030
1 in 300/ 82.0	18.4	1,440	3,000	2.1	1,560

'50-year amortization period; interest rate 7.75 percent; October 1996 price levels

the alternative corresponding to the 1 in 200 annual event at a PNP elevation of 64.5 feet had a first cost of $2.7 million, average annual costs of $200,000, average annual benefits of $280,000, a benefit-to-cost ratio of 1.4, and net benefits of $80,000. Reach 3, the alternative corresponding to the 1 in 300 annual event at a PNP elevation of 82.0 feet had a first cost of $18 million, average annual costs of $1.4 million, average annual benefits of $3.0 million, a benefit-to-cost ratio of 2.1, and net benefits of $1.6 million. The design for each reach that has the most net benefits is identified as the NED plan.

Identification of the NED Plan

The NED plan for each reach is identified in **Table V-2.** All three reaches are separately economically justified and are included in the overall NED plan.

Linda/Olivehurst Plan (Reach 1). The NED plan for Linda/Olivehurst (reach 1) is a combination of slurry wall, berm, and toe drain corresponding to the PNP at 83.0 feet. Levee raising would be required in six areas and would range from 0.5 feet to 1.5 feet. The NED design for Linda/Olivehurst (reach 1) would provide flood protection for a 1 in 250 annual event. The design for reach 1 would require 1.3 miles of new slurry wall construction, 5 miles of increased slurry wall, 1.4 miles of berm, 1 mile of levee reshaping and 4.7 miles of modified berm and drain.

Lower RD 784 Plan (Reach 2). The NED plan for lower RD 784 (reach 2) is a slurry wall corresponding to the PNP at 64.5 feet. The plan includes deepening slurry walls between levee miles 25.12 and 26.07 on the Feather River. The deepened slurry walls would be 50 feet deep. No levee raising would be required in this reach. The NED design for the lower RD 784 area (reach 2) would provide flood protection for a 1 in 200 annual event. The design for reach 2 would require 0.5 mile of increased slurry wall, 0.79 mile of toe drain, 0.5 mile of berm, and 2.2 miles of modified berm and drain.

Marysville Area Plan (Reach 3). The NED plan for Marysville (reach 3) appears to be in excess of the elevation corresponding to the PNP at 82.0 feet. **Table VI-1** shows that the annual costs do not change for the PNP level from 81.0 feet to 82.0 feet while the benefits continue to increase. The upper range of the analysis was stopped at the 1 in 300 annual event. This event is a reasonable maximum because events of this magnitude and rarity would likely be accompanied by a high level of uncertainty due to upstream levee failures and the resulting flooding. Although the net benefits did not maximize before the 1 in 300 annual event, this is a reasonable estimate of the NED plan. The plan consists of new slurry walls, toe drains, and widening existing berms on the existing levee around the city. There would be no levee raising associated with this reach. The design for reach 3 would require 1 mile of slurry wall on the Yuba River right bank, 1.3 miles of slurry wall and berm on the Feather River left bank, and 2.8 miles of slurry wall and berm on Jack Slough left bank.

Benefits

Benefits are defined as the reduction in damages due to the implementation of the proposed project. The without-project damages for reach 1 is $3.2 million, reach 2 is $518,000, and reach 3 is $4.7 million. The without-project damages represent the average annual damages that could occur in any given year. With-project benefits are the damages that could be reduced by a flood control project.

Costs

The cost estimate, based on the Code of Accounts Cost Estimating procedures, was made for the NED plan. The cost estimate for the NED analysis

Table V-2. Summary of the NED Plan

Annual Event	First Investment Costs $million	Average Annual Costs $1,000	Average Annual Benefits $1,000	Benefit/ Cost Ratio	Net Benefits $1,000
Reach 1- Linda/ Olivehurst					
1 in 250	16.0	1,500	2,300	1.5	800
Reach 2 - lower RD 784					
1 in 200	2.7	210	280	1.4	80
Reach 3 - Marysville					
1 in 300	18.0	1,400	3,000	2.1	1,600

50-year amortization period; interest rate 7.75 percent; October 1996 price levels

was calculated in October 1996. The cost estimate for the advanced work to be constructed in conjunction with the System Evaluation is included in Chapter VI. Any constructed advanced work would change the NED analysis if conducted after the work is in place.

Incremental Analysis

The study area was divided into three independent reaches, which means that each reach must stand alone and cannot justify work in another reach. Reach 1 (Linda/Olivehurst) is bordered by the Yuba and Feather Rivers. The work proposed in reach 1 consists of slurry wall, toe drain, and berm for the NED plan. This plan consists of levee strengthening measures and does not include any work that would change the hydraulic profile. Although there is some levee raising proposed in the NED plan for reach 1 (maximum raise of 1.5 feet for 0.28 mile). The hydraulic impacts on reach 3 is negligible. By improving reach 1, reach 2 is provided with an increase in flood protection level. Reaches 1 and 2 are separable because of the hydraulic control index points on the Yuba and Feather Rivers. The index point for reach 1 is on the Yuba River while the index point for reach 2 is on the Feather River. Flooding in reach 1 does affect reach 2.

However, the urbanized reach 1 is affected by shallow sheetflow flooding, while reach 2, mostly agricultural area, can reach flood depths in excess of 20 feet.

Flooding caused by a breach in reach 2 can cause minor damages in reach 1. The NED plan for reach 2 entails slurry wall, berm, and/or toe drain. Providing the NED plan to reach 2, without performing any work in reach 1, would continue to be influenced/threatened by the index point in reach 1. Reaches 1 and 2 could be combined due to the location of the weakest point and its effect on reach 2. However, the closer a failure scenario is to the Bear River, the less likely that reach 1 would be affected.

The NED plan for reach 3 consist of slurry wall and berm. The Marysville ring levee has sufficient height to provide increased flood protection without changing the hydraulic profile. Providing reach 3 with the NED plan would have a negligible effect on reach 1 with the backwater effect, but even less effect on reach 2.

Environmental Effects

The potential effects of the NED plan on environmental resources in the project area were evaluated in detail, and results of the studies are presented in the final EIS/EIR. Potential adverse effects of the plan are identified and quantified when possible, and measures to reduce these effects to less than significant are presented.

Based on the results of the environmental studies, resources not affected by the NED plan are climate; topography, geology, and soils; water quality; fisheries; socioeconomics; recreation; and hazardous, toxic, and radiological waste. The affected resources include land use, transportation, noise, air quality, vegetation and wildlife, special status species, and cultural resources.

Since a majority of the levee improvement work for the NED plan would not change the existing levee heights, the direct environmental effects are minor. Most environmental effects would result from construction activities and would only be temporary. These effects would include (1) disruption of land use on levee slopes and staging areas, (2) increases in traffic, (3) increases in equipment noise levels, (4) increases in combustion emissions and dust, and (4) disruption of 54.71 acres of grassland and agricultural vegetation on levee slopes and staging areas. After construction, most land use and vegetation would return to pre-construction conditions. The increased levels of combustion emissions are only temporary and would not exceed *de minimus* thresholds established by the U.S. Environmental Protection Agency. Therefore, an in-depth conformity analysis is not required. Since the other temporary effects could be reduced to levels of insignificance with best management practices, no mitigation measures would be required.

The NED plan would have permanent effects on land use, vegetation and wildlife, and special status species. About 16.55 acres of land use would change from woodland, grassland, and agriculture to the flood control project, but the change is not significant because the land use is compatible with current local land use plans. The NED plan would result in the loss of 2.23 acres of woodland and 14.32 acres of grassland and agricultural habitats. Mitigation would include using 2.98 acres of "credit" at the existing mitigation site for Phase II of the System Evaluation. Special status species that could be affected are the giant garter snake, valley elderberry longhorn beetle, and Swainson' hawk. Construction activities could result in the loss or disturbance of these species and their habitats. Numerous avoidance and mitigation measures are proposed for the three species, and these measures will be finalized during consultation with the FWS.

Cultural resources could also be affected by the project although no adverse effects have been identified to date. In accordance with a Memorandum of Agreement coordinated with the State Historic Preservation Officer, a records search and field surveys of the remainder of the Area of Potential Effect will be accomplished prior to initiation of construction to identify any additional sites. If any sites are located during these surveys, these sites will be evaluated for their eligibility for the National Register. If any sites are determined to be eligible, an effect determination will be performed by the Corps, and consultation with the State Historic Preservation Officer will be initiated. The main types of possible effects in this study are (1) physical destruction or damage during construction and (2) isolation or alteration of the character of the site's setting by the modified levees or berms.

Accomplishments

The NED plan would increase flood protection to Linda/Olivehurst and lower RD 784 to the 1 in 250 annual event and the 1 in 200 annual event, respectively. Marysville's flood protection would increase to a 1 in 300 annual event.

The NED plan provides benefits in accordance with Engineering Regulation 1105-2-100. This plan is functionally complete to provide the flood control for the study area. The NED plan would effectively reduce flooding to the study area. A combination of slurry wall, toe drains, and berms provides the highest net benefits of $1.3 million for reach 1, $80,000 for reach 2, and $1.6 million for reach 3. The NED plan meets the planning criteria of acceptability.

Recommended Plan

The participation of the non-Federal sponsor in plan selection is essential because the non-Federal sponsor must share in the cost of studies and construction and provide long-term maintenance and operation. Without this participation, it would not be possible to proceed with a project.

The recommended plan, which varies from the NED plan, was requested by the non-Federal sponsor. In this case, the recommended plan has less work than

the NED plan. The recommended plan is supported by the Reclamation Board. The local sponsor's decision to construct the advanced work by deepening the slurry wall corresponding to the PNP of 82.5 prevents the NED plan corresponding to the PNP of 83.5 from being achieved at a later date at the same cost provided in the NED analysis. Once the slurry wall is in place for the design, the cost associated with achieving deeper sections of slurry wall requires construction of an entire wall continuous to the new depth. The recommended plan is similar to the NED plan and consists of providing new slurry walls, deepening slurry wall, new and modified toe drains, and widening existing berms to achieve a 1 in 200 annual event for reaches 1 and 2, and a 1 in 300 annual event for reach 3. The local sponsor did not have the opportunity to achieve the NED in reach 1. The optimization of the NED plan was identified after the local sponsor's decision to construct advanced work that would set the depth of the slurry wall. Time constraints affected the opportunity to include advanced work into the Phase II contract. The advanced work associated with this plan prevents the NED plan from being achieved at the same cost identified in the analysis.

CHAPTER VI - THE SELECTED PLAN

DESCRIPTION OF PLAN

This chapter describes the features, accomplishments, and effects of the selected plan, which is the recommended plan. The non-Federal sponsor supports this plan which meets the State's requirement for urban areas to have at least flood protection against a 1 in 200 annual event.

Physical Features

The non-Federal sponsor is pursuing advanced work to be constructed in conjunction with the System Evaluation project. The advanced work was identified as a part of the levee modification plans considered in Chapter V. The non-Federal sponsor's application for potential credit under Section 104 of Public Law 99-662 for the cost of the advanced work to be applied to the non-Federal share of the authorized construction project was approved by the Assistant Secretary of the Army (Civil Works) by memorandum dated 4 October 1996. The advanced work is not considered as part of the without-project condition.

The Selected Plan consists of strengthening levees by constructing toe drains, berms, and slurry walls on the three study area reaches along the Feather and Yuba Rivers. The proposed levee construction work for the TSP is shown on **Plate 13**.

The work on the Yuba River left bank would consist of deeper slurry wall between levee miles 0.00 and 0.28, new slurry wall from levee miles 0.92 to 1.23, deeper slurry wall between levee miles 1.23 and 1.79, enlarged berm between levee miles 1.77 and 2.18, deeper slurry wall between levee miles 2.22 and 2.92, enlarged berm between levee miles 2.92 and 3.56, a new berm between levee miles 3.56 and 3.59, and modified berm and drain between levee mile 3.59 and 3.86. Also on the Yuba River left bank levee consists of levee reshaping between levee mile 3.86 to 4.20 and new slurry wall between levee mile 4.20 and 6.10. The work on the Feather River east bank for the Selected Plan would consist of deeper slurry wall between levee miles 17.18 and 17.70, a new berm between levee miles 20.49 and 23.64, a new slurry wall between levee miles 23.64 and 25.12, and a deeper slurry wall between levee miles 25.12 and 26.07. The work for the Marysville ring levee consists of waterside slurry wall and berm between levee miles 25.81 and 27.08.

Real Estate requirements for the Selected Plan are 10 feet of permanent easement beyond the toe of any proposed new facilities. In addition, construction would require another 30 feet of temporary easement beyond the permanent easement limits. These construction easements would be acquired for a 2-year period to ensure adequate time to complete construction contracts. The proposed construction of a landside berm in Reaches 1 and 2 would require the relocation of four single family residences, three in Reach 1 and one in Reach 2. **Table VI-1** provides details for the work needed to provide flood protection against the 1 in

200 annual event for reaches 1 and 2 and flood protection against the 1 in 300 annual event for reach 3.

Table VI-1. Features of the Tentatively Selected Plan

Location	Levee Miles	Type of Work
Yuba River Left Bank	0.00 to 0.28	Increase slurry wall depth; slurry wall 42' to 46'; raise levee 0.5'
Reach 1	0.28 to 0.35	-
	0.35 to 0.92	Berm and drain; berm 9' x 16'
	0.92 to 1.23	Slurry wall 38' to 42'
	1.23 to 1.79	Increase slurry wall depth; slurry wall 40' to 45'
	1.77 to 2.18	Modify berm and drain; berm 9' x 18'
	2.18 to 2.22	-
	2.22 to 2.97	Increase slurry wall depth; slurry wall 35' to 40'
	2.92 to 3.56	Modify berm and drain; berm 8'x 16'
	3.56 to 3.59	Berm and drain; berm 8'x 16'
	3.59 to 3.86	Modify berm and drain; berm 8'x 16'
	3.86 to 4.20	Berm and drain
	4.20 to 6.10	Slurry wall
Feather River Left Bank Reach 1	26.07 to 25.12	Increase slurry wall depth; slurry wall 40' to 50'; raise levee 0.5'
	25.12 to 23.64	Slurry wall 45'
	23.64 to 22.25	Modify berm and drain; berm 10'x 16'
	22.25 to 21.42	Modify berm and drain; berm 10'x 14'
	21.42 to 20.49	Modify berm and drain; berm 9'x 14'
	20.49 to 20.00	Raise berm 2'; 200' wide
Feather River Left Bank Reach 2	20.00 to 19.66	Raise berm 2'; 200' to 700' wide
	19.66 to 19.03	Modify berm and drain; berm 10'x 14'
	19.03 to 18.84	Raise berm 2'; 100' wide
	18.84 to 18.37	Modify berm and drain; berm 9'x 14'
	18.37 to 17.58	Modify toe drain; berm 8'x 15'
	17.58 to 17.10	Modify berm and drain; berm 10'x 14'
	17.12 to 16.59	Increase slurry wall depth; slurry wall 48' to 50'
	16.61 to 15.98	Modify berm and drain; berm 9'x 14'
Yuba River Right Bank Reach 3	0.00 to 1.00	Slurry wall 30'; berm 5'x 12'
Feather River Left Bank Reach 3	25.81 to 26.21	Slurry wall 28'; berm 5'x 12'
	26.21 to 27.08	Slurry wall 38'; berm 5'x 12'
Jack Slough Left Bank Reach 3	0.00 to 0.25	Slurry wall 30'; berm 5'x 12'
	0.25 to 0.68	
	0.68 to 3.25	Slurry wall 30'; berm 5'x 12'

Table VI-1 indicates that there would be about 3.7 miles new slurry wall, 2.5 miles of increased slurry wall, 1.4 miles of berm, and 4.5 miles of modified berm in reach 1. There would also be 0.8 mile of toe drain, 0.5 mile of berm, 0.5 mile of increased slurry wall, and 3 miles of modified berm in reach 2. Reach 3 would consist of about 5 miles of slurry wall and berm.

Accomplishments

The Selected Plan would decrease the frequency of flooding to the Linda/Olivehurst and lower RD 784 areas from a 1 in 63 annual event to about a 1 in 200 annual event. The Marysville area frequency of flooding would decrease from a 1 in 114 annual event to a 1 in 200 annual event.

The main benefits from the Selected Plan would be flood damage reduction benefits to existing structures within the study area. Reaches 1 and 2 would be protected from a 1 in 200 annual event and reach 3 from a 1 in 300 annual event. The without project condition average annual damages changed from the NED analysis due to adjustment to the depth-damage curves and different price level projections. The without project average annual damages are $2,463,000 for reach 1, $695,000 for reach 2 (reinventory after January 1997 event), and $5,641,000 for reach 3 for a total of $8.8 million. Refined flood damage reduction analysis determined benefits to be about $1.6 million for reach 1, $230,000 for reach 2, and $3.5 million for reach 3, as shown in **Table VI-2.**

Table VI-2. Economic Summary of Tentatively Selected Plan

Alternative	First Costs[1]	Annual Costs ($1,000)			Annual Benefits[1]	B/C Ratio	Net Benefits ($1,000)
	Total	Annual Costs	OM&R	Total			
1 in 200 Reach 1	12,810	1031	0	1031	1.6	1.6	569
1 in 200 Reach 2	2,881	211	0	211	0.230	1.1	19
1 in 300 Reach 3	10,390	824	0	824	3.5	4.3	2,676

[1]$millions
50-year amortization period; 7.125 interest rate; October 1997 price levels

The Selected Plan satisfies all planning objectives of the study; that is, the plan reduces potential flood damages to Linda/Olivehurst, lower RD 784, and Marysville, while mitigating environmental effects and preserving cultural resources in the study area. **Table VI-3** shows how the Selected Plan meets the objectives and criteria established in Planning Principles and Guidelines.

Table VI-3. Accomplishments of the Tentatively Selected Plan

Formulation and Evaluation Criteria	Accomplishments
Technical	The Selected Plan is consistent with local county plans and meets the requirements of the National Flood Insurance Program. The Selected Plan does not significantly affect preproject conditions for floods exceeding project design.
Economic	The Selected Plan deviates from the NED plan to provide consistent levels of protection for reaches 1 and 2 (entire RD 784 area). The Reclamation Board has a requirement to support new projects in urban areas to provide flood protection against a 1 in 200 annual event at a minimum.
Environmental	The Selected Plan was formulated to minimize adverse effects on the natural environment and cultural resources. Mitigation measures for permanent effects were based on coordination with the U.S. Fish and Wildlife Service.
Social	The Selected Plan considered safety and health issues associated with effects of a project. General public acceptance of this plan will be determined through public meetings, informal meetings, letters, and other public involvement.
Completeness	The Selected Plan is less than the NED plan, but provides and accounts for the investment of $28.0 million with a B/C ratio of 2.6 to 1.
Effectiveness	The Selected Plan reduces potential flood damages in the study area, preserves the environmental and cultural resources, while meeting the Federal objective of water and related land resource planning. The Selected Plan achieves the maximum average annual equivalent benefits of $5.3 million at annual costs of about $2.1 million (October 1997 price levels).
Efficiency	The NED plan was the most cost-effective means of reducing the risk of flooding, but the Selected Plan also provides a cost effective means of realizing opportunities consistent with protecting the Nation's environment.
Acceptability	The Selected Plan meets the objectives of the State and local interests of providing additional flood protection to the study area.

In essence, the Selected Plan achieves the maximum average annual equivalent benefits of $5.3 million at annual costs of about $2.1 million (October 1997 price levels).

Hydraulic Mitigation

Hydraulic effects are project-induced increases in flood risk in adjacent or downstream areas. No identifiable hydraulic effects are caused by the Selected Plan. There are no increases to flood depths for events in the study area because the Selected Plan does not require raising levees above 1 foot. The Selected Plan would not increase the flood threat to areas upstream from the project. All property in the study reaches would be safer under with-project conditions due to the reduction in the frequency of flooding in each area.

In addition, a determination was made that the minor hydraulic effects associated with the Selected Plan did not result in a "taking" within the meaning of the 5th amendment of the United States Constitution, thus necessitating payment of just compensation and acquisition of the affected property. Generally, a "taking" occurs when there is either a physical appropriation of private property or a substantial interference with the property which destroys or decreases its value.

Results of the hydraulic analysis indicated that implementation of the Selected Plan would not affect adjacent and downstream areas. However, the water-surface elevation in the channel and frequency of levee failure for each of the three areas would increase slightly if the Selected Plan were constructed.

With respect to hydraulic effects on depth, duration, and frequency of flooding in the downstream areas, there is no certainty that levee failure would occur or where it would happen. Considering that the property in the areas is designated for agricultural use, there is no indication that either the value or use of the property is significantly affected by potential project-induced flooding. Based on the analysis, it was determined that hydraulic mitigation measures were not needed as part of the design features of the levee alternatives.

Advanced Work

A portion of Phase II of the System Evaluation includes the construction of slurry walls. One advantage of deepening the slurry wall as advanced work is that it eliminates the need for duplication of the slurry wall construction in the future. **Table VI-4** compares the Phase II and the advanced work. The non-Federal sponsor requested Section 104 credit approval for additional work during Phase II to be applied toward a future Federal project resulting from this feasibility study. Section 104 (Public Law 99-992) authorizes and directs the development of guidelines which include criteria for determining whether work carried out by non-Federal interests is compatible with a project for flood control. Advanced work was identified in the feasibility phase to be constructed in conjunction with the System Evaluation project. The non-Federal sponsor requested that credit under

Section 104 be provided for any compatible project proposed in the Yuba River feasibility study that is subsequently authorized and funded for construction. Engineering Regulation 1165-2-29 provides the guidance and procedures for general credit for flood control under Section 104 of Public Law 99-662. The application for potential credit under Section 104 was approved by the Assistant Secretary of the Army (Civil Works) by memorandum dated 4 October 1996. The advanced work in Phase II was awarded for construction in January 1997.

Table VI-4. Phase II Work and Proposed Advanced (Section 104) Work

Levee Mile	Phase II Work	Advanced Work
Yuba River - South Levees (Reach 1)		
0.00 - 0.28	Slurry Wall 30'	Deepen slurry wall 42'-46'
0.92 - 1.23	No work	New slurry wall 38'-42'
1.23 - 1.79	Slurry wall 25'- 30'	Deepen slurry wall 40'-45'
1.77 - 2.18	6'x 10' berm 8'drain	8' x 14' berm 8' drain
2.22 - 2.92	slurry wall 20'- 28'	Deepen slurry wall 25'-40'
2.92 - 3.56	5'x10' berm 8' drain	7' x 14' berm 8' drain
3.56 - 3.59	No work	6' x 10' berm
Feather River - East Levees		
17.18 - 17.70	Slurry wall 35'- 40	Deeper slurry wall 45'-50'
20.49 - 23.64 (Reach 1)	No work	New berm
23.64 - 25.12 (Reach 2)	No work	New slurry wall 45'
25.12 - 26.07 (Reach 2)	Slurry wall 30'- 40'	Deeper slurry wall 40'-50'

The cost of the advanced work identified in **Table VI-4** is estimated to be $2.7 million. **Table VI-5** shows the breakdown of the cost estimate for the advanced work. To date, $2.7 million for the advanced work in the System Evaluation project has been provided by the non-Federal sponsor. All of the advanced work is compatible with the Selected Plan.

Table VI-5. Advanced Work Cost Estimate[1]

Account	Advanced Work - Reach 1	Advanced Work - Reach 2	Advanced Work
01 Lands & Damages	0	0	0
02 Relocations	0	0	0
06 Fish & Wildlife	0	0	0
11 Levee Modification	700	1,500	2,200
18 Cultural	0	0	0
30 Planning Engrg & Design	100	200	300
31 Construction Management	100	100	200
Total	900	1,800	2,700

[1]$1,000 - October 1996 price levels

OPERATION AND MAINTENANCE

After the project is completed, ownership would be transferred to the non-Federal sponsor. The non-Federal sponsor would be responsible for the operation and maintenance, replacement, and rehabilitation of the project. The Corps would provide a water control manual and operation and maintenance manual to regulate how the non-Federal sponsor operates, maintains, and rehabilitates the facilities. The Corps has the responsibility to ensure that the non-Federal sponsor inspects, operates, maintains, and rehabilitates the project facilities according to the criteria provided in these manuals to ensure that a safe project is maintained.

Currently, the levees are operated and maintained as part of the Sacramento River Flood Control System. These operation and maintenance practices are not expected to change after implementation of the Selected Plan. Since the associated costs would not change, there would be no additional operation and maintenance costs associated with the Selected Plan.

ENVIRONMENTAL EFFECTS AND MITIGATION

The potential effects of the Selected Plan plan on environmental resources in the project area were evaluated in detail, and results of the studies are presented in the final EIS/EIR. Potential adverse effects of the plan are identified and quantified when possible, and measures to reduce these effects to less than significant are presented.

Based on the results of the environmental studies, resources not affected by the Selected Plan plan are climate; topography, geology, and soils; water quality; fisheries; socioeconomics; recreation; and hazardous, toxic, and radiological

waste. The affected resources include land use, transportation, noise, air quality, vegetation and wildlife, special status species, and cultural resources.

Most environmental effects would result from construction activities and would only be temporary. These effects would include (1) disruption of land use on levee slopes and staging areas, (2) increases in traffic, (3) increases in equipment noise levels, (4) increases in combustion emissions and dust, and (4) disruption of 40.38 acres of grassland and agricultural vegetation on levee slopes and staging areas. After construction, most land use and vegetation would return to pre-construction conditions. The increased levels of combustion emissions and dust are only temporary and would not exceed *de minimus* thresholds established by the U.S. Environmental Protection Agency. As a result, an in-depth conformity analysis would not be required. Since the other temporary effects could be reduced to levels of insignificance with best management practices, no mitigation measures would be required.

The Selected Plan plan would have permanent effects on land use, vegetation and wildlife, and special status species. About 16.55 acres of land use would change from woodland, grassland, and agriculture to the flood control project, but the change is not significant because the land use is compatible with current local land use plans. The Selected Plan plan would result in the loss of 2.23 acres of woodland and 14.32 acres of grassland and agricultural habitats. Mitigation would include using 2.98 acres of "credit" at the existing mitigation site for Phase II of the System Evaluation. Special status species that could be affected are the giant garter snake, valley elderberry longhorn beetle, and Swainson' hawk. Construction activities could result in the loss or disturbance of these species and their habitats. Numerous avoidance and mitigation measures are proposed for the three species, and these measures will be finalized during consultation with the FWS.

Cultural resources could be also affected by the project although no adverse effects have been identified to date. Additional surveys are still needed to identify the cultural resources in parts of the project area. These surveys will be done prior to construction in accordance with a Memorandum of Agreement coordinated with the State Historic Preservation Officer.

ECONOMIC ANALYSIS

Estimates of costs and benefits for this plan are based on October 1997 price levels, a 7-1/8 (7.125) percent interest rate, and a 50-year period of analysis. With a project life of 50 years, the interest rate is adjusted to the capital recovery factor of 7.59 percent. Construction would begin in 2000 and be completed in 2002.

Since cultural resources mitigation may be required in reach 3, additional studies have been included in the cost estimate for that reach. Based on coordination with the U.S. Fish and Wildlife Service and The Reclamation Board (the non-Federal sponsor), mitigation "credit" from the Phase II site would be used

to mitigate for the adverse effects of the Selected Plan. As a result, there is no cost associated with mitigation lands included in the detailed cost estimate for the Selected Plan.

The summary cost estimate is shown on **Table VI-6**. Estimated first and annual costs and benefits are summarized in **Tables VI-7 through VI-9**. The estimated first cost is about $13.9 million, and the average annual cost is about $1 million for reach 1. The estimated first cost for reach 2 is about $2.9 million, and the average annual cost is about $211,000. The estimated first cost for reach 3 is about $11 million, and the average annual cost is about $824,000.

Table VI-6. Economic Summary of Tentatively Selected Plan

Items	Reach 1	Reach 2	Reach 3	Total
First Cost	$12,810,000	$2,650,000	$10,390,000	25,850,000
Annual Costs	$1,031,000	$211,000	$824,000	2,066,000
Annual Benefits	$1,622,000	$230,000	$3,527,000	5,379,000
Net Benefits	$591,000	$19,000	$2,703,000	3,313,000
Benefit-Cost Ratio	1.6	1.1	4.3	2.6

50-year amortization period; interest rate 7.125 percent; October 1997 price levels

Table VI-7. Selected Plan Cost Estimate - First Costs (Reach 1)

Type	Description	Federal ($)	Non-Federal ($)	Total ($)
01	Lands and Damages	70,000	1,200,000	1,270,000
11	Levee	9,880,000		9,880,000
30	Planning, Engineering and Design	1,190,000		1,190,000
31	Construction Management	470,000		470,000
Subtotal		11,610,000	1,200,000	12,810,000
5% cash contribution		(640,000)	640,000	
Cost Adjustment		(2,640,000)	2,640,000	
Total		8,330,000	4,480,000	12,810,000

October 1997 price levels

REVISED - SEPTEMBER 1998

Table VI-8. Selected Plan Cost Estimate - First Costs (Reach 2)

Type	Description	Federal ($)	Non-Federal ($)	Total ($)
01	Lands and Damages	40,000	730,000	770,000
11	Levee	1,530,000		1,530,000
30	Planning, Engineering and Design	230,000		230,000
31	Construction Management	120,000		120,000
Total		1,920,000	730,000	2,650,000
5% Cash Contribution		(132,500)	132,500	
Cost Adjustment		(67,500)	67,500	
Total		1,720,000	930,000	2,650,000

October 1997 price levels

Table VI-9. Selected Plan Cost Estimate - First Costs (Reach 3)

Type	Description	Federal ($)	Non-Federal ($)	Total ($)
01	Lands and Damages	45,000	570,000	615,000
11	Levee	7,883,000		7,883,000
18	Cultural Resources Preservation	168,000		168,000
30	Planning, Engineering and Design	1,144,000		1,144,000
31	Construction Management	580,000		580,000
Subtotal		9,820,000	570,000	10,390,000
5% Cash Contribution		(420,000)	420,000	
Cost Adjustment		(2,620,000)	2,620,000	
Total		6,780,000	3,610,000	10,390,000

October 1997 price levels

REVISED - SEPTEMBER 1998

RELIABILITY ANALYSIS

The reliability analysis represents the percent chance of not failing a particular design for a specified flood event. The reliability analysis provides additional information about the functional performance of the project. The results determine the reliability of a particular project size to contain a specific event. For example, **Table VI-10** shows that the 200-year true exceedance project (true exceedance in column 2) would pass the 1 in 100 and 1 in 200 annual events, should they occur, with 86 percent and 78 percent assurance, respectively.

Table VI-10. Reliability of Levee Performance

PNP	Annual Event	1 in 500	1 in 250	1 in 200	1 in 150	1 in 100	1 in 50
	Reach 1						
80.1	100	42		64		74	83
81.6	150	52		73	77	81	90
81.7	161	53		74		82	91
82.5	200	59		78		86	94
83.0	250	62	76	81	85	88	95
83.5	277	66		84		90	96
PNP	Reach 2						
64.5	200	42		78	82	87	97
65.2	300	49		83	87	90	98
PNP	Reach 3	1 in 500	1 in 300	1 in 200	1 in 150	1 in 100	1 in 50
80	150	50		78	81	85	90
81	200	56		83		88	94
82	300	63	75	87		91	96

The reliability analysis is included to identify the differences in project reliability and performance data so that the non-Federal sponsor can determine what level of risk is acceptable for the community.

The reliability analysis concludes that the Selected Plan has an 86 percent reliability for the 1 in 100 annual event for reach 1, an 87 percent reliability for the 1 in 100 annual event for reach 2, and an 91 percent reliability for the 1 in 100 annual event for reach 3. There is no levee certification requirement for any plan recommended by this feasibility report since the System Evaluation project will meet the requirements for levee certification under the Federal Emergency Management Agency's requirements.

VII - PLAN IMPLEMENTATION

PROCEDURES FOR IMPLEMENTATION

Report Review and Approval

The draft feasibility report and draft EIS/EIR were extensively reviewed by Federal, State, and local agencies as well as private groups and individuals, and their comments were incorporated into the final report. The Corps has submitted the final report to its Washington-level Review Center, published a public notice of completion of the study, and filed the final EIS/EIR with the U.S. Environmental Protection Agency. The Chief of Engineers will submit the report to the Assistant Secretary of the Army, who will then transmit the report to the Office of Management and Budget for comments before submittal to Congress.

Project Authorization

Once the feasibility report is approved and the project is authorized by Congress, construction funds will be required. The project will be considered for inclusion in the President's budget based on (1) national priorities, (2) magnitude of the Federal commitment, (3) economic and environmental feasibility, (4) level of local support, (5) willingness of the non-Federal sponsor to fund their share of the project cost, and (6) any budgetary constraints at the time of funding. Federal budget recommendations will be based on evidence of support of the non-Federal sponsor and the ability and willingness of the non-Federal sponsor to share in the project cost. Once the Congress appropriates the Federal share of funds, the Assistant Secretary of the Army (Civil Works) and the non-Federal sponsor will sign a project cooperation agreement, which will define the Federal and non-Federal responsibilities for implementing, operating, and maintaining the project according to requirements established by the Congress and the Administration.

COST-SHARING RESPONSIBILITIES

Federal

Following completion of the final feasibility report and EIS/EIR and the authorization of the project by Congress, the Federal Government will prepare detailed plans and designs, including plans and specifications. After completion of the plans and specifications, the Federal Government will construct the project after funds are appropriated and non-Federal interests provide the 5 percent cash contribution, lands, easements, rights-of-way, relocations, and assurances for the non-Federal cooperation requirements.

Non-Federal

Current Federal regulations require non-Federal participation in the financing of projects. In accordance with the Water Resources Development Act of 1996 and other requirements, the non-Federal sponsor will:

- Provide a cash contribution of 5 percent of the total project first cost assigned to structural flood control.

- Provide all lands, easements, and rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the project.

- Pay during project construction such additional amounts so that the total contribution of the non-Federal sponsor is not less than 35 percent, but does not exceed 50 percent, of the total project first cost assigned to structural flood control.

- Hold and save the United States free from damages due to construction, operation, maintenance, repair, replacement, and rehabilitation of the project, except for damages due to the fault or negligence of the United States or its contractor.

- Maintain, operate, repair, replace, and rehabilitate all completed work, without cost to the United States, in accordance with regulations prescribed by the Secretary of the Army. Monitor the status of completed mitigation and provide periodic reports on its condition and repairs and replacement if needed.

- Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646; 84 Stat. 1984), as amended.

- Publicize flood plain information in the area and provide this information to zoning and other regulatory agencies for guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to ensure compatibility between future development and protection levels provided by the project.

- Participate in and comply with applicable Federal flood plain management and flood insurance programs and comply with the requirements in Section 402 of the Water Resources Development Act of 1986, as amended.

- Perform at the time of initiation of construction, and thereafter, any environmental investigations as determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601) on all lands necessary for project construction, operation, maintenance, repair, replacement, and rehabilitation.

- Assume complete financial responsibility for the cleanup of any hazardous materials located on project lands and regulated under CERCLA and be

responsible for operating, maintaining, repairing, replacing, and rehabilitating the project in a manner so that liability will not arise under CERCLA.

- Inform affected interests, at least annually, regarding the limitations of the protection afforded by the project.

- Prescribe and enforce, to the extent of its power, regulations preventing obstruction of or encroachment on project works that would reduce the level of protection afforded or hinder operation, maintenance, repair, replacement, and rehabilitation.

- Prevent future encroachment or modifications which might interfere with proper functioning of the project.

- Provide guidance and leadership to prevent unwise future development in the flood plain.

- Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

- Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

- Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

- Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

- Provide 35 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to flood control that are in

excess of one percent of the total amount authorized to be appropriated for flood control.

- Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project;

- Participate in and comply with applicable Federal flood plain management and flood insurance programs in accordance with Section 402 of Public Law 99-662.

- Within 1 year after the date of signing a project cooperation agreement, prepare a flood plain management plan designed to reduce the effect of future flood events in the project area. This plan will be prepared in accordance with guidelines developed by the Government. The plan must be implemented no later than 1 year after completion of construction of the project.

- Any parts of the proposed advanced work identified in this feasibility report, approved for credit under Section 104, Public Law 99-662 and constructed is recommended on the basis that the advanced work is compatible with the recommended project for flood control. The credit will not relieve the non-Federal sponsor of the requirement to pay 5 percent of the project costs in cash during construction of the remainder of the project.

Federal and non-Federal obligations and requirements will be defined in a project cooperation agreement signed prior to initiation of construction. The non-Federal funds will not need to be provided until after Congress authorizes the project and appropriates construction funds and a project cooperation agreement is signed. Payment of the funds with the exception of the 5 percent cash contribution will be made at intervals during the construction.

COST APPORTIONMENT

The cost estimate for the selected plan for Linda/Olivehurst, lower RD 784, and Marysville is shown in **Table VII-1**. The non-Federal share with Section 104 credit applied would reduce the non-Federal share by $2.7 million to $6.4 million.

The total project investment cost is the interest during construction added to the project first cost. Interest during construction is not used in the economic analysis. The total project investment cost is included in **Table VII-2**.

NON-FEDERAL FINANCIAL ANALYSIS

The Reclamation Board will be the non-Federal cost-sharing sponsor and will provide the non-Federal requirements of the project.

Table VII-1. Apportionment of First Costs for The Selected Plan

Type	Description	Federal ($)	Non-Federal ($)	Total ($)
01	Lands and Damages	155,000	2,500,000	2,655,000
11	Levee	19,293,000		19,293,000
18	Cultural Resource Preservation	168,000		168,000
30	Planning, Engineering and Design	2,564,000		2,564,000
31	Construction Management	1,170,000		1,170,000
Subtotal		23,350,000	2,500,000	25,850,000
Non-Federal 5% Cash Contribution		(1,290,000)	1,290,000	
Non-Federal Cost Share Adjustment		(5,230,000)	5,230,000	
Project First Cost		16,830,000	9,020,000	25,850,000
Section 104 Credit			(2,700,000)	
Non-Federal Share w/ 104 Credit Applied			6,320,000	

October 1997 price levels

Table VII-2. Total Project Investment Cost

Type of Cost	Reach 1 ($)	Reach 2 ($)	Reach 3 ($)
First Cost	12,810,000	2,650,000	10,390,000
IDC[1]	1,080,000	231,000	806,000
Investment Cost	13,890,000	2,881,000	11,196,000
Total Project Investment Cost - Reaches 1-3			27,967,000

[1]Interest during construction

50-year amortization period; interest rate 7.125 percent; October 1997 price levels

REVISED - SEPTEMBE

The State (through The Reclamation Board) has a plan for financing a share of the non-Federal costs of a project. The plan includes authorization (Section 12657 of the California Water Code) for the State to pay for its share of lands, easements, rights-of-way, and relocations on Federally authorized flood control projects in the Sacramento and San Joaquin Valleys. The State, in cooperation with the YCWA, will pay all of the non-Federal capital costs, including the cash requirement, lands, easements, rights-of-way, and relocations, and ensure that the project will be maintained to Federal standards. Section 12585.5 of the Water Code provides for the State to pay 70 percent of the non-Federal capital costs; 70 percent of the non-Federal costs of fish and wildlife mitigation; and 70 percent of the non-Federal planning, engineering, and design costs. The YCWA will pay the remaining 30 percent.

The non-Federal sponsor will be responsible for the operation, maintenance, repair, replacement, and rehabilitation of the completed project. State law requires The Reclamation Board to pass on these responsibilities and their costs to the local beneficiaries of the project. Maintenance activities will likely be provided by the local reclamation districts. The Reclamation Board will furnish funds for the State share of the project costs by appropriations made by the State legislature.

Based on the financing plans of The Reclamation Board and YCWA, sufficient funds will be available for all non-Federal costs for whichever plan is recommended for implementation.

VIEWS OF NON-FEDERAL INTERESTS

The Reclamation Board and the YCWA have shown support for the study. Their commitment is demonstrated through the construction of the advanced work. The non-Federal sponsor strongly supports construction of this project.

CHAPTER VIII - PUBLIC INVOLVEMENT

Public involvement activities included notices, ongoing interagency coordination, informal meetings, and formal presentations. All activities were designed to keep study participants and interested organizations and individuals up-to-date on the progress of the study and provide an opportunity for public comments.

On August 10, 1992, an intent to prepare a draft EIS for the Yuba River Basin study was published in the Federal Register. This notice provided information on the project and encouraged nationwide comment.

The Corps coordinated closely with The Reclamation Board and the YCWA, as well as other Federal and State agencies, during formulation and evaluation of alternative plans. These informal meetings and correspondence were designed to obtain information, resolve issues, and encourage local support for potential flood control work.

The Corps also made several formal presentations to the non-Federal sponsor, YCWA, and Yuba County officials. On June 10, 1992, the Corps presented the status of the Yuba River Basin study at a special meeting of the Board of Directors of the YCWA. The discussion focused on technical activities and the study schedule. On September 10, 1996, the Corps presented the status of the Yuba River Basin study to the Yuba County Board of Supervisors. The discussion focused on the NED analysis, advance work requirements, and the Section 104 application.

A public workshop was held on March 6, 1998, to discuss the results of the feasibility study and receive comments on the draft report and EIS/EIR. All comments were considered when finalizing the feasibility report and EIS/EIR, and responses to the comments are included as an appendix to the final EIS/EIR.

CHAPTER IX - CONCLUSIONS

Major conclusions of the feasibility study are:

- The history of flooding in Marysville and the Linda/Olivehurst area shows that there will continue to be an ongoing flood threat to lives and property from high flows due to intense rainfall and runoff events.

- Even with the existing flood protection provided by the Sacramento River Flood Control System, the area is still vulnerable to major flooding as demonstrated by the recent flood in January 1997.

- Sediment inflow is important to the continued stability of the Yuba and Feather River channels. Additional upstream storage could upset the erosion/sedimentation process, leading to downcutting or meandering.

- The levee work proposed in the Selected Plan consists of extensions, modifications, and/or additions to the reconstruction work approved under the Phase II of the System Evaluation.

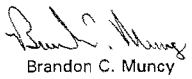
- The Selected Plan is similar to the NED plan for lower RD 784. The Selected Plan for the Linda/Olivehurst and Marysville areas requires less slurry wall, toe drain, and berm work than the NED plan. The Selected Plan is supported by the non-Federal sponsor. The Selected Plan has a benefit-to-cost ratio of 1.6 for Linda/Olivehurst, 1.1 for lower RD 784, and 4.3 for Marysville.

- The total investment cost for the Selected Plan is about $28 million, and the net benefit for the plan is $3.3 million.

CHAPTER X - RECOMMENDATION

In accordance with the cost-sharing policy in the Water Resources Development Act of 1996, the Selected Plan plan would be cost shared (5 percent cash, total non-Federal minimum share of 35 percent), and the non-Federal sponsor would pay 100 percent of the incremental costs of the Selected Plan. I recommend that improvements for flood damage reduction along the Yuba and Feather Rivers be authorized subject to cost sharing that is consistent with this Federal policy. This recommendation is also subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies listed in Chapter VII.

The recommendation in this report reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the non-Federal sponsor (The Reclamation Board), interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.



Brandon C. Muncy
Major, Corps of Engineers
Acting District Engineer

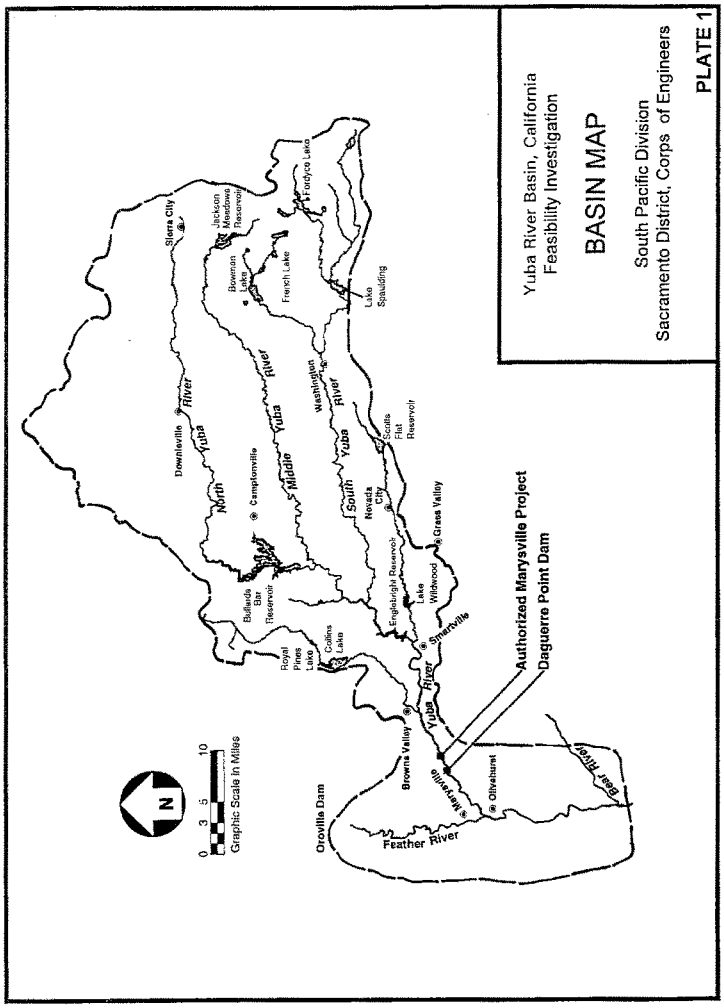
CESPD-ET-P (April 1998) (1105) 1st End Converse/tjm/415-977-8163
SUBJECT: Feasibility Report for the Yuba River Basin Investigation, California

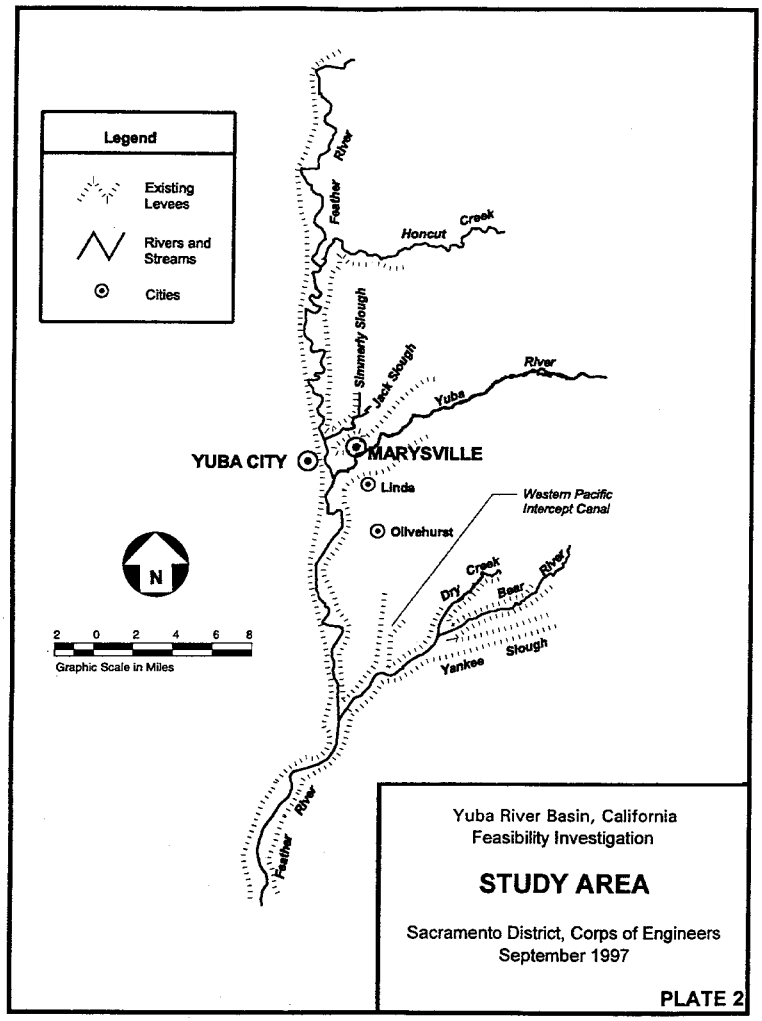
DA, South Pacific Division, Corps of Engineers, 333 Market Street, Room 923
San Francisco, CA 94105-2195 15 April 1998

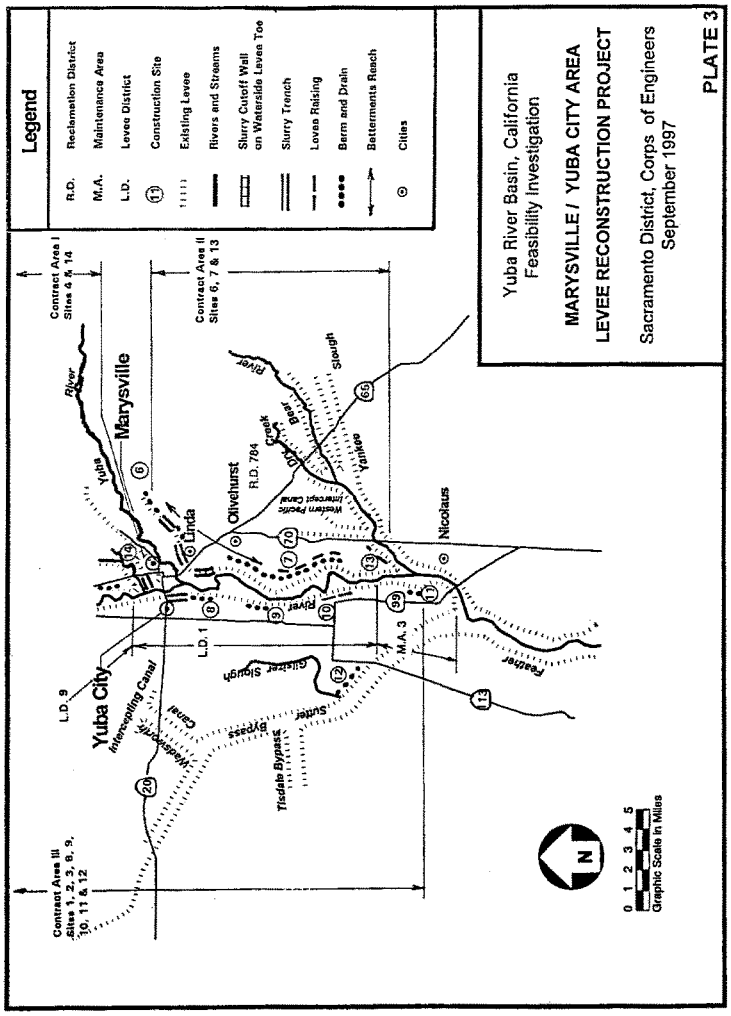
FOR CDR USACE (CECW-AR), 7701 Telegraph Road, Alexandria, VA 22315-3861

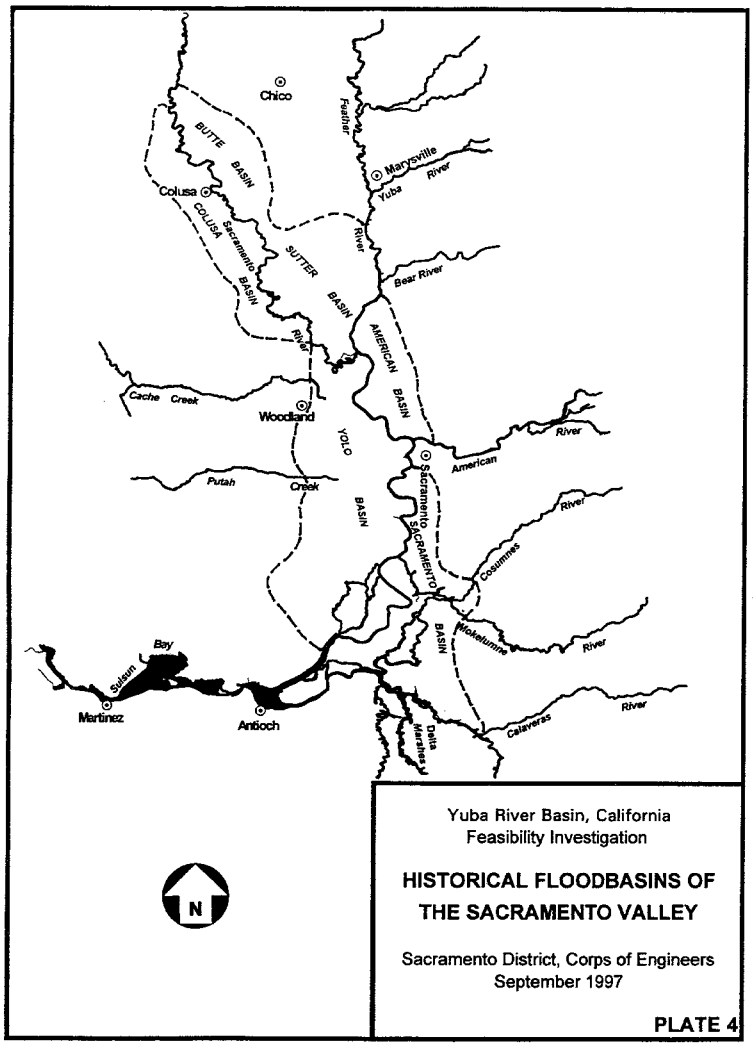
I concur in the conclusions and recommendations of the District Commander.

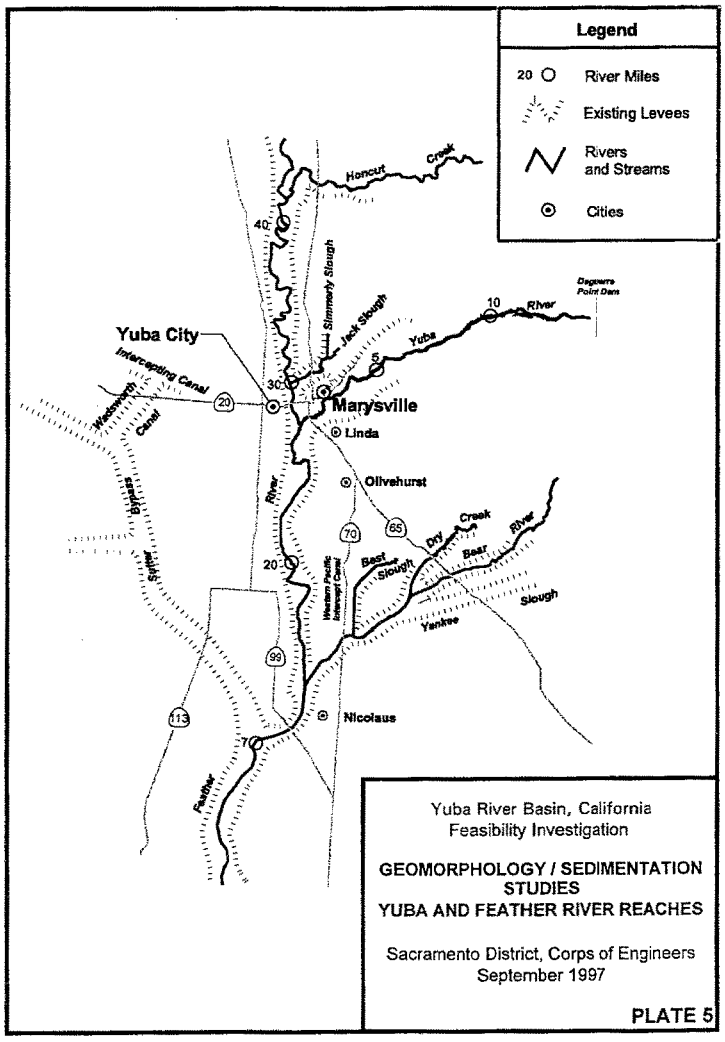
PETER A. TOPP
COL, EN
Acting Commander

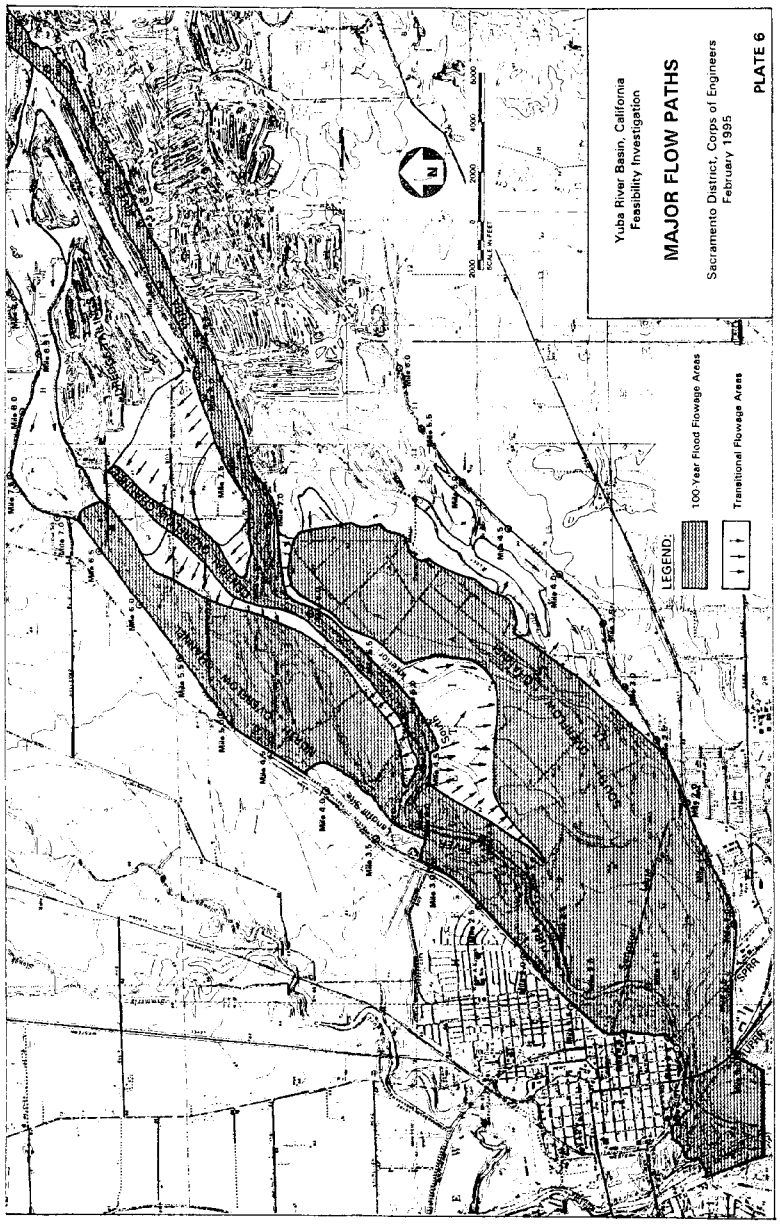

Yuba River Basin, California
Feasibility Investigation
BASIN MAP
South Pacific Division
Sacramento District, Corps of Engineers
PLATE 1
Authorized Marysville Project
Daguerre Point Dam
Graphic Scale in Miles
0 5 10
N
Sierra City
Jackson Meadows Reservoir
Bowman Lake
Fordyce Lake
French Lake
Lake Spaulding
Downieville
Yuba River
North
Yuba River
Middle
Yuba River
South
Washington
Scotts Flat Reservoir
Nevada City
Grass Valley
Englebright Reservoir
Lake Wildwood
Camptonville
Bullards Bar Reservoir
Collins Lake
Royal Pines Lake
Smartsville
Yuba River
Marysville
Olivehurst
Browns Valley
Oroville Dam
Feather River
Bear River

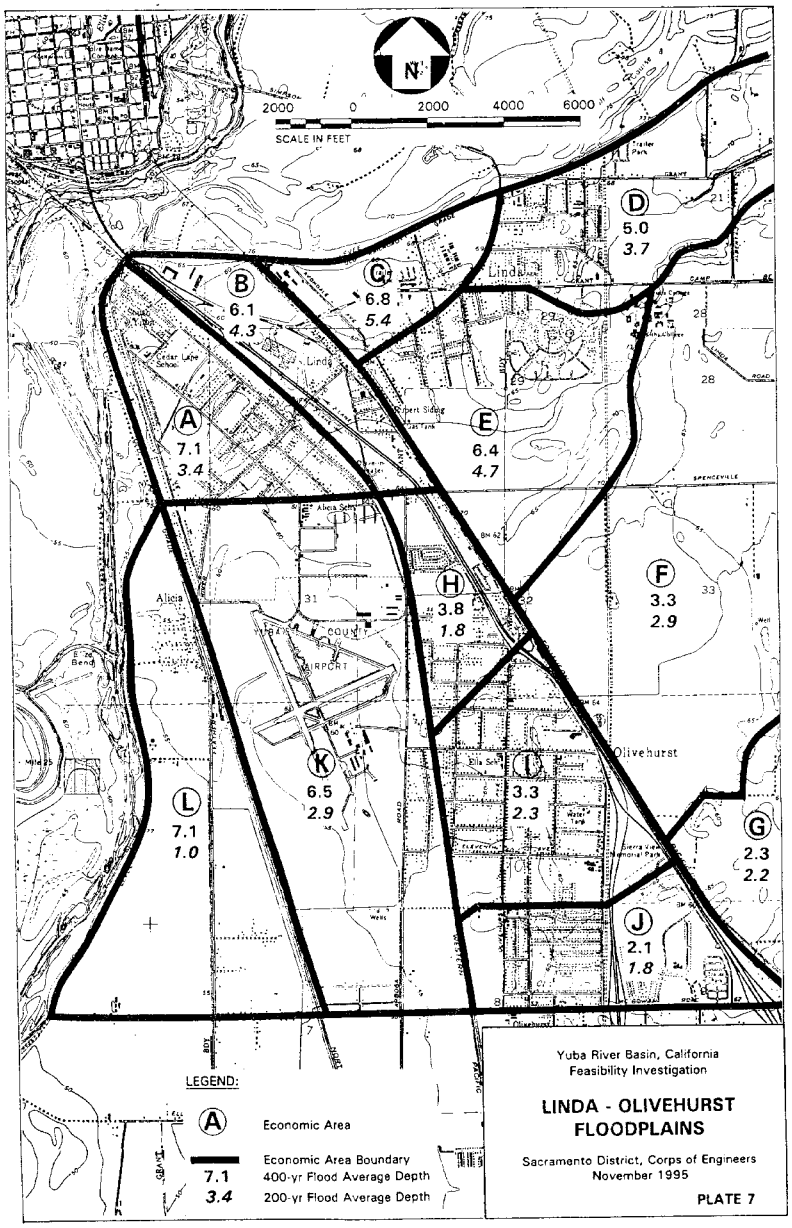

Legend
Existing Levees
Rivers and Streams
Cities
Feather River
Honcut Creek
Simmerly Slough
Jack Slough
Yuba River
YUBA CITY
MARYSVILLE
Linda
Olivehurst
Western Pacific Intercept Canal
Dry Creek
Bear River
Yankee Slough
Feather River
N
2 0 2 4 6 8
Graphic Scale in Miles
Yuba River Basin, California
Feasibility Investigation
STUDY AREA
Sacramento District, Corps of Engineers
September 1997
PLATE 2

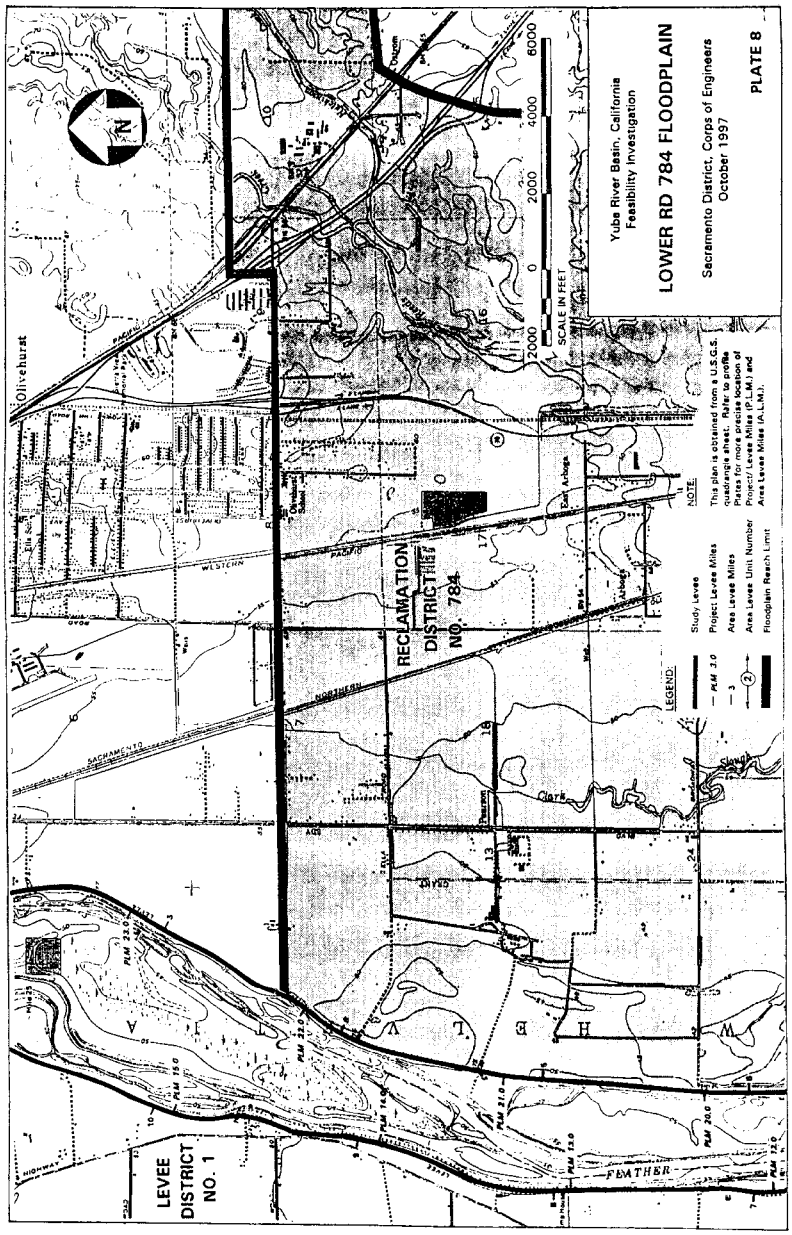

Legend
R.D. Reclamation District
M.A. Maintenance Area
L.D. Levee District
Construction Site
Existing Levee
Rivers and Streams
Slurry Cutoff Wall on Waterside Levee Toe
Slurry Trench
Levee Raising
Berm and Drain
Batterments Reach
Cities
Yuba River Basin, California
Feasibility Investigation
MARYSVILLE / YUBA CITY AREA
LEVEE RECONSTRUCTION PROJECT
Sacramento District, Corps of Engineers
September 1997
PLATE 3
Contract Area I
Sites 4, 5, 14
Contract Area II
Sites 6, 7 & 13
Contract Area III
Sites 1, 2, 3, 8, 9, 10, 11 & 12
Marysville
Yuba City
Olivehurst
Linda
Nicolaus
R.D. 784
L.D. 9
L.D. 1
M.A. 3
Intercepting Canal
Tisdale Bypass
Graphic Scale in Miles
0 1 2 3 4 5

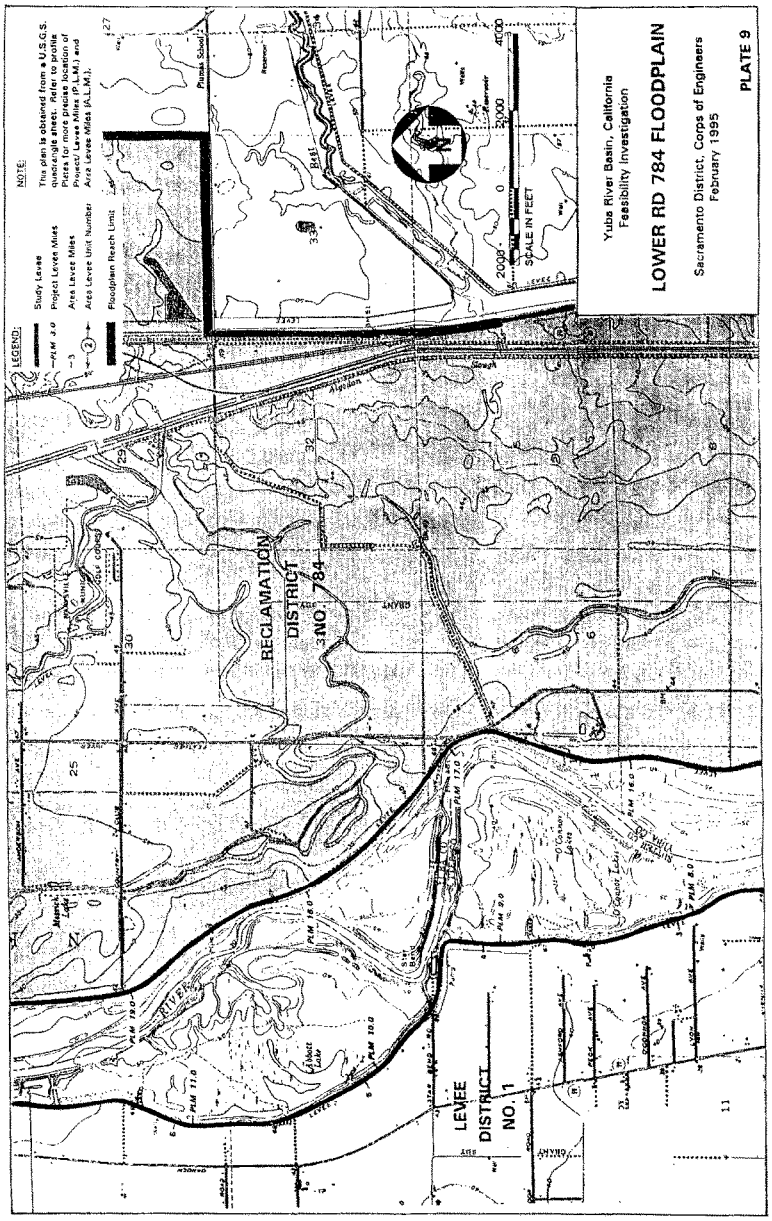

Chico
Feather
BUTTE
BASIN
Marysville
River
Yuba
Colusa
COLUSA
Sacramento
BASIN
SUTTER
River
BASIN
Bear River
AMERICAN
BASIN
RIVER
Cache Creek
Woodland
YOLO
BASIN
American
River
Putah
Creek
Sacramento
SACRAMENTO
River
Cosumnes
Mokelumne
River
BASIN
Bay
Suisun
Martinez
Antioch
Delta
Marshes
Calaveras
River
N
Yuba River Basin, California
Feasibility Investigation
HISTORICAL FLOODBASINS OF
THE SACRAMENTO VALLEY
Sacramento District, Corps of Engineers
September 1997
PLATE 4

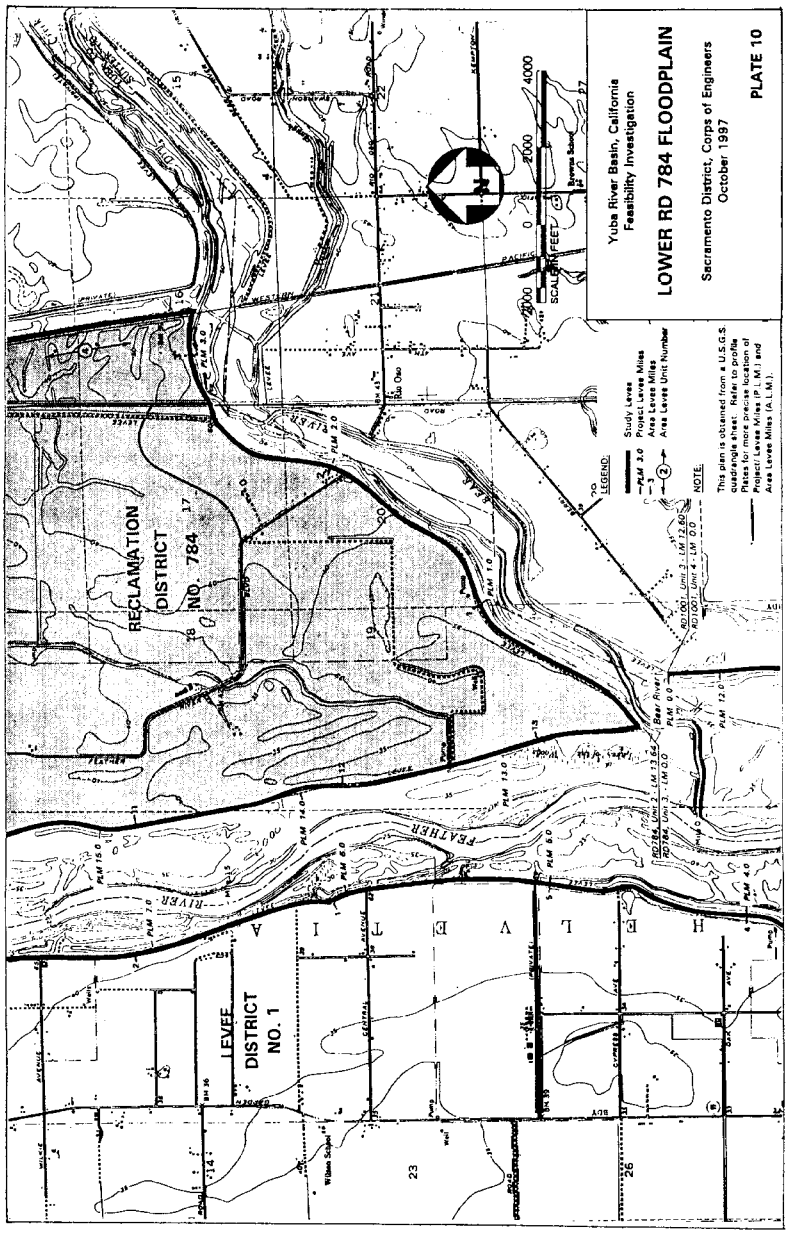

Legend
20 River Miles
Existing Levees
Rivers and Streams
Cities
Honcut Creek
Simmerly Slough
Jack Slough
Yuba River
Oroville Dam
Yuba City
Intercepting Canal
Wadsworth Canal
Marysville
Linda
Olivehurst
Bear River
Dry Creek
Bear River
East Slough
Western Pacific Interceptor Canal
Yankee Slough
Nicolaus
Feather River
Yuba River Basin, California
Feasibility Investigation
GEOMORPHOLOGY / SEDIMENTATION STUDIES
YUBA AND FEATHER RIVER REACHES
Sacramento District, Corps of Engineers
September 1997
PLATE 5

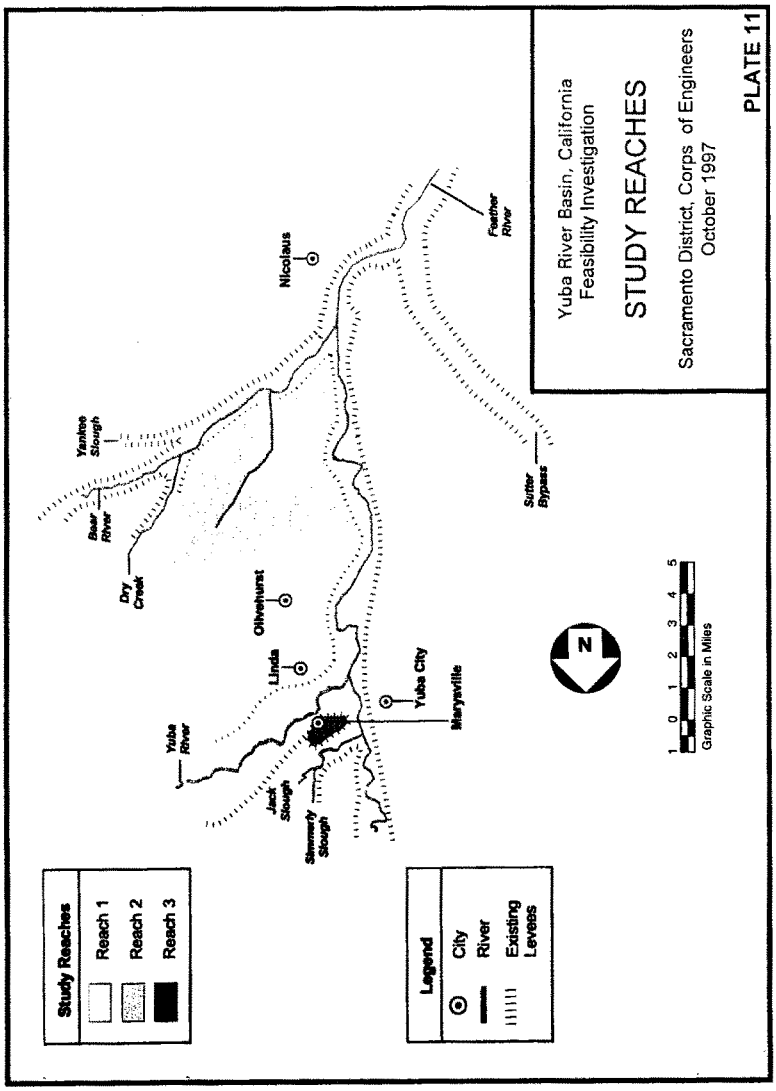

Yuba River Basin, California
Feasibility Investigation
MAJOR FLOW PATHS
Sacramento District, Corps of Engineers
February 1995
PLATE 6
LEGEND:
100-Year Flood Flowage Area
Transitional Flowage Area
N
Feather River
Yuba River
Bear River
Marysville
Linda
Olivehurst
Plumas Lake
Arboga
Wheatland
Beale AFB
Sutter Bypass
Yuba Bypass
Sutter Slough
Honcut Creek
Dry Creek
Best Slough
Gilsizer Slough
Hutchinson Creek
Ellis Lake
Meridian
Sutter
Live Oak
Gridley
Oroville
Chico
Oroville Dam
Lake Oroville
Thermalito Afterbay
Thermalito Diversion Dam
Thermalito Forebay
Oroville-Wyandotte Irrigation District Canal
Western Canal
Richvale
Biggs
Gridley
Colusa
Willows
Orland
Glenn
Princeton
Butte City
Maxwell
Sacramento River
Colusa Basin Drainage Canal
Colusa Trough
Sacramento River Flood Control Project
Tisdale Bypass
Knights Landing Ridge Cut
Knights Landing
Woodland
Davis
Winters
Dunnigan
Arbuckle
Zamora
Yolo
Sacramento
Cache Creek
Cache Creek Settling Basin
Yolo Bypass
Fremont Weir
Sacramento Weir
Colusa Weir
Moulton Weir
Tehama-Colusa Canal
Delevan
Maxwell
Stony Creek
Black Butte Dam
Black Butte Lake
Glenn-Colusa Irrigation District Canal
Sacramento River Flood Control Project
Sacramento River
Feather River
Yuba River
Bear River
Marysville
Linda
Olivehurst
Plumas Lake
Arboga
Wheatland
Beale AFB
Sutter Bypass
Yuba Bypass
Sutter Slough
Honcut Creek
Dry Creek
Best Slough
Gilsizer Slough
Hutchinson Creek
Ellis Lake
Meridian
Sutter
Live Oak
Gridley
Oroville
Chico
Oroville Dam
Lake Oroville
Thermalito Afterbay
Thermalito Diversion Dam
Thermalito Forebay
Oroville-Wyandotte Irrigation District Canal
Western Canal
Richvale
Biggs
Gridley
Colusa
Willows
Orland
Glenn
Princeton
Butte City
Maxwell
Sacramento River
Colusa Basin Drainage Canal
Colusa Trough
Sacramento River Flood Control Project
Tisdale Bypass
Knights Landing Ridge Cut
Knights Landing
Woodland
Davis
Winters
Dunnigan
Arbuckle
Zamora
Yolo
Sacramento
Cache Creek
Cache Creek Settling Basin
Yolo Bypass
Fremont Weir
Sacramento Weir
Colusa Weir
Moulton Weir
Tehama-Colusa Canal
Delevan
Maxwell
Stony Creek
Black Butte Dam
Black Butte Lake
Glenn-Colusa Irrigation District Canal


N
2000 0 2000 4000 6000
SCALE IN FEET
A 7.1 3.4
B 6.1 4.3
C 6.8 5.4
D 5.0 3.7
E 6.4 4.7
F 3.3 2.9
G 2.3 2.2
H 3.8 1.8
I 3.3 2.3
J 2.1 1.8
K 6.5 2.9
L 7.1 1.0
Linda
Olivehurst
Alicia
AIRPORT
LEGEND:
A Economic Area
Economic Area Boundary
7.1 400-yr Flood Average Depth
3.4 200-yr Flood Average Depth
Yuba River Basin, California
Feasibility Investigation
LINDA - OLIVEHURST FLOODPLAINS
Sacramento District, Corps of Engineers
November 1995
PLATE 7


Yuba River Basin, California
Feasibility Investigation
LOWER RD 784 FLOODPLAIN
Sacramento District, Corps of Engineers
October 1997
PLATE 8
SCALE IN FEET
8000
4000
2000
0
2000
NOTE
This plan is obtained from a U.S.G.S. quadrangle sheet. Refer to profile sheets for more complete location of Project Levee Miles (P.L.M.) and Area Levee Miles (A.L.M.).
LEGEND
Study Levee
Project Levee Miles
Area Levee Miles
Area Levee Unit Number
Floodplain Reach Limit
RECLAMATION DISTRICT NO. 784
LEVEE DISTRICT NO. 1
Olivehurst
Clark
FEATHER
YUBA

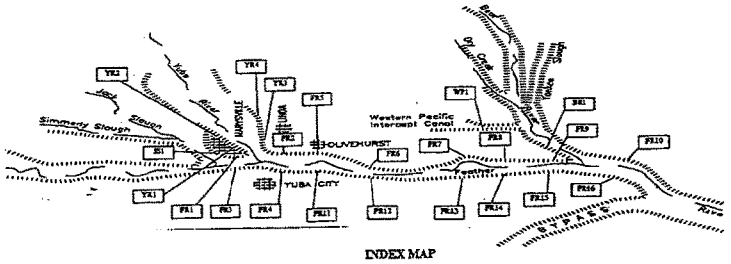

LEGEND:
Study Levee
Project Levee Miles
Area Levee Miles
Area Levee Unit Number
Floodplain Reach Limit
NOTE:
This plan is obtained from a U.S.G.S. quadrangle sheet. Refer to profile Plates for more precise location of Project/ Levee Miles (P.L.M.) and Area Levee Miles (A.L.M.).
RECLAMATION DISTRICT NO. 784
LEVEE DISTRICT NO. 1
Yuba River Basin, California
Feasibility Investigation
LOWER RD 784 FLOODPLAIN
Sacramento District, Corps of Engineers
February 1995
PLATE 9
SCALE IN FEET
2000
4000


Yuba River Basin, California
Feasibility Investigation
LOWER RD 784 FLOODPLAIN
Sacramento District, Corps of Engineers
October 1997
PLATE 10
LEGEND:
Study Levee
Project Levee Miles
Area Levee Miles
Area Levee Unit Number
NOTE:
This plan is obtained from a U.S.G.S. quadrangle sheet. Refer to profile Plates for more precise location of Project/ Levee Miles (P.L.M.) and Area Levee Miles (A.L.M.).
SCALE IN FEET
RECLAMATION DISTRICT NO. 784
LEVEE DISTRICT NO. 1
FEATHER
RIVER
H E L V E T I A


Yuba River Basin, California
Feasibility Investigation
STUDY REACHES
Sacramento District, Corps of Engineers
October 1997
PLATE 11
Study Reaches
Reach 1
Reach 2
Reach 3
Legend
City
River
Existing Levees
Graphic Scale in Miles
Yuba River
Bear River
Dry Creek
Yankee Slough
Jack Slough
Simmerly Slough
Olivehurst
Linda
Yuba City
Marysville
Nicolaus
Feather River
Sutter Bypass
N

YUBA RIVER FEASIBILITY STUDY
RISK AND UNCERTAINTY ANALYSIS DATA

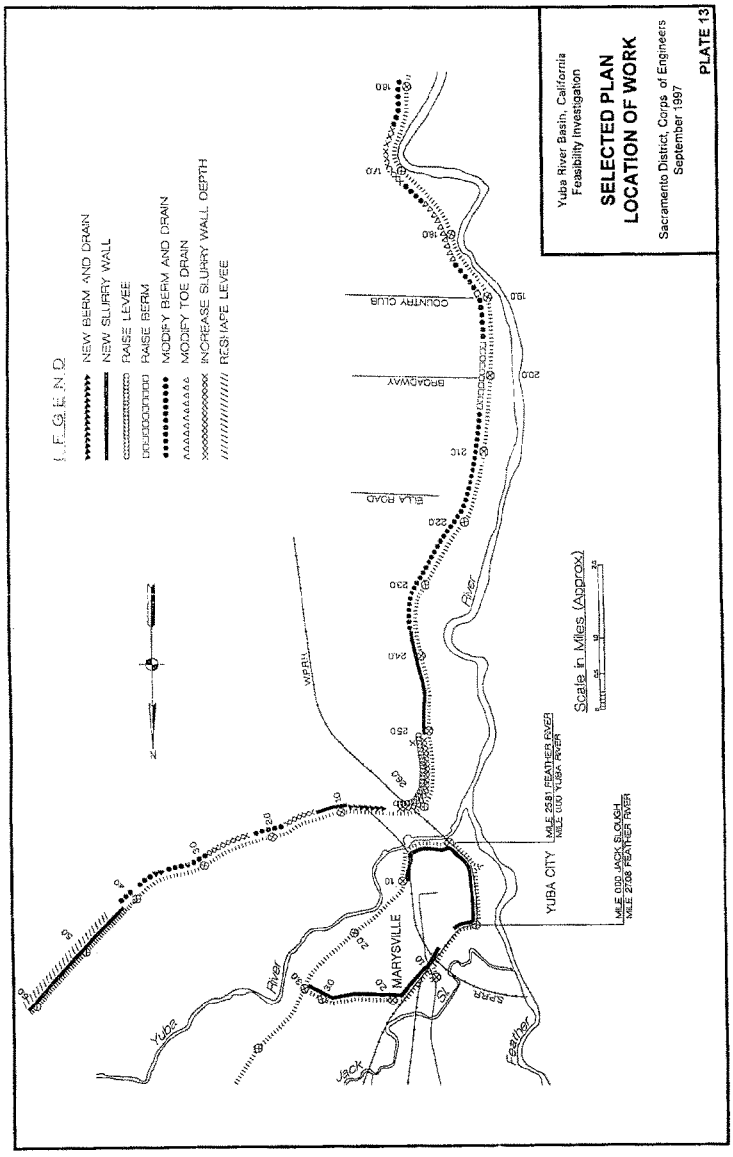
INDEX POINT	RIVER MILE	LEVEE MILE	TOP OF LEVEE	LEVEE BANK	PNP	PFP
Reach 1-Linda/Olivehurst						
YR4	2.75	1.9	82	left	78	80
YR3	1.15	0.5	80.2	left	77.1	79.1
FR2	26.65	24.9	78.5	left	74.8	76.8
FR5	24	22.4	75.2	left	71.6	74.6
Reach 2- Lower RD 784						
FR6	21	19.4	71.2	left	66.2	69.2
FR7	17	16.2	65	left	62	64
FR8	15	14.3	63	left	57.8	60.8
FR9	13	12.6	59.1	left	54.5	57.5
FR10	9.2	9.1	57.6	left	50	52
BR1	2	1.7	59	right	55.5	58.5
WP1	1	1	62.2	right	57.8	60.8
Reach 3 - Marysville						
JS1	1.4	0.95	84.4	left	78.4	81.4
FR1	28.85	26.9	88.6	left	77.7	80.7
YR1	1	0.5	85.5	right	77.15	81.15
YR2	2.5	1.96	86.4	right	79	83
Feather River - Right Bank Levees						
FR3	28.85	26.9	88.6	right	77.7	80.7
FR4	26.65	17.6	79.5	right	74.8	77.8
FR11	24	14.6	77	right	71.6	73.6
FR12	21	11.7	70.7	right	66.2	68.2
FR13	17	8.6	65.8	right	62	64
FR14	15	6.7	63	right	57.8	59.8
FR15	13	4.9	62.8	right	54.5	58.5
FR16	9.2	1.5	54.6	right	50	54



INDEX MAP

N

PLATE 12


LEGEND
NEW BERM AND DRAIN
NEW SLURRY WALL
RAISE LEVEE
RAISE BERM
MODIFY BERM AND DRAIN
MODIFY TOE DRAIN
INCREASE SLURRY WALL DEPTH
RESHAPE LEVEE
Yuba River Basin, California
Feasibility Investigation
SELECTED PLAN
LOCATION OF WORK
Sacramento District, Corps of Engineers
September 1997
PLATE 13
Scale in Miles (Approx)
MARYSVILLE
YUBA CITY
COUNTRY CLUB
BROADWAY
ELLA ROAD
WPRR
SPRR
Yuba River
Jack Feather

YUBA RIVER BASIN INVESTIGATION, CALIFORNIA

Final Feasibility Report

Appendix B

ECONOMICS, JANUARY 1998

FEASIBILITY STUDY

ECONOMIC ANALYSIS

YUBA RIVER BASIN
CALIFORNIA

U.S. Army Corps Of Engineers
Sacramento District
Economics Branch
JANUARY 1998

BASIS OF ECONOMIC ANALYSIS
YUBA RIVER BASIN INVESTIGATION
(January 1998)

INTRODUCTION

The Yuba River Basin study area was divided into three reaches for economic analysis and plan formulation. Reach 1 contains the cities of Linda and Olivehurst and is located south of the Yuba River and east of the Feather River. Reach 2 is located south of McGowan road, and (lower Reclamation District 784) along the left bank of the Feather River from River Mile 21 to the Bear River. Reach 3 consists of urban areas of Marysville, which includes the entire area enclosed by surrounding ring levee (**See figure** 1). The Economic Analysis describes the data and methodology used to determine without project damages and project benefits. Economic benefits were developed in accordance with ER 1105-2-100. ER 1105-2-101 was used in doing the risk-based portion of the analysis. This analysis is based upon a 50-year project life, October 1997 price levels, and discount rate of 7-1/8. Economic data collected for the (August 1996) NED report was used as basis for this current analysis. That data was in October 1996 price levels. Price level was updated to October 1997 price levels by using 1997 Marshall Valuation Service (Marshall and Swift).

FLOOD HISTORY

Frequent floods have occurred in the Yuba River Basin, damaging agricultural, commercial, industrial and residential areas along the Yuba and Feather Rivers. The Sacramento District Corps of Engineers initiated a flood control study of the basin in 1989. Preliminary results indicated that at least one alternative plan to raise levees along the Feather and Yuba rivers was economically feasible. The non-federal sponsors for the study are the State of California Reclamation Board and Yuba County Water Agency.

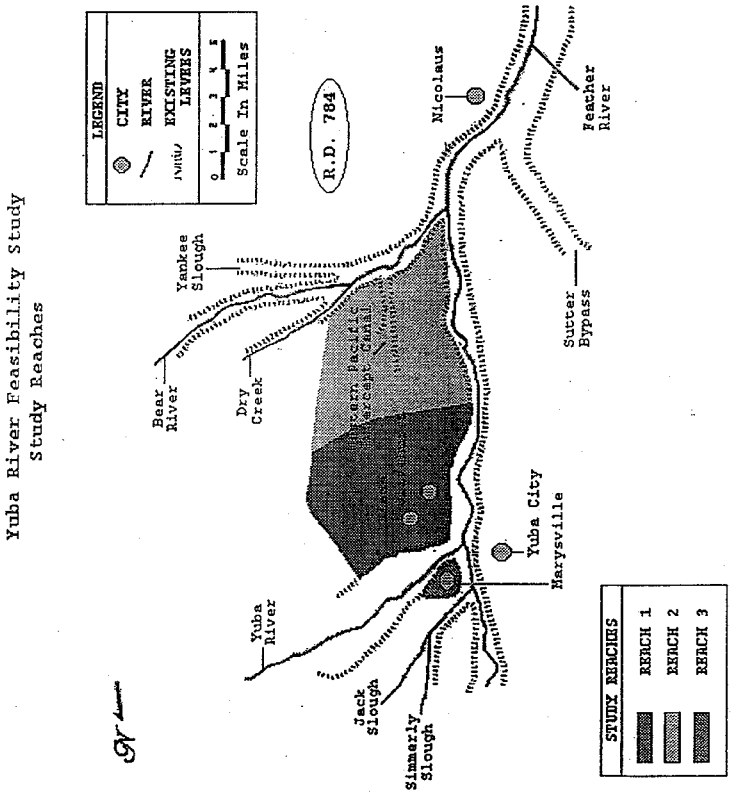

Yuba River Feasibility Study
Study Reaches
LEGEND
CITY
RIVER
EXISTING LEVEES
Scale In Miles
R.D. 784
Nicolaus
Feather River
Yankee Slough
Bear River
Dry Creek
Sutter Bypass
Yuba City
Marysville
Yuba River
Jack Slough
Simmerly Slough
STUDY REACHES
REACH 1
REACH 2
REACH 3

Figure 1

METHODOLOGY

This report presents a description of the methodology used to calculate damages and benefits for the benefit-cost ratio. Benefits are expressed as average annual values at a federal discount rate of 7-1/8 percent with a project life of 50 years. The project base year (the year in which benefits will accrue from project construction) is 2002. All damages and benefits are expressed in October 1997 price levels.

FLOOD PLAIN

The Yuba River Basin study was divided into three reaches.

Yuba River Study Area
7 1/8% Interest Rate
October 1997 Prices
Reaches 1, 2 & 3

Reach	Location
1	Olivehurst and Linda
2	RD 784
3	Marysville

Flood plains were developed for all three reaches. Reach 1 contains approximately 8,838 acres, and locates within 200-year and 400 year flood plain. Reach 2 has 18,748 acres, and locates within 200-year and 400-year flood plain. Reach 3 is located within 200-year and 400-year flood plain, but contains no agricultural acres. Commercial, industrial, public and semi-public, and residential, properties represent this area . See (**Table 1**) for complete breakdown of the total acreage for 200-year and 400-year flood plain by reach. Different areas within each reach were assigned different depths of flooding before the "Risk and Uncertainty" computer program was applied. The depth of flooding in reach 1 for a 200-year event ranges from 1 feet to 5 feet while a 400-year event varies from 2 feet to 7 feet. Reach 2 depths vary from 2 feet to 22 feet for a 200-year event and a 400-year event. Reach 3 has an average depth of 18 feet.

Table 1
Yuba River Basin
Reach 1, 2 & 3
Flood Plain Agricultural Acreage
7 1/8% Interest Rate
October 1997 Prices
200 & 400 year flood plains

REACH	200 YEAR	400 YEAR
1	410	8,428
2	18,748	18,748
3	0	0

PHYSICAL UNITS

The number of existing damageable units are shown below in **Table 2** for Reaches 1, 2 and 3. There are approximately 6,033 units in Reach 1, 807 units in Reach 2 and 5,519 units in Reach 3.

TABLE 2
Yuba River Basin Study
Total Number of Damageable Units by Land Use Category
7 1/8% Interst Rate
October 1997 Prices
Reaches 1, 2 & 3

	Reach 1	Reach 2	Reach 3
Residential	5,735	691	4,950
Commercial	171	3	358
Industrial	29	8	61
Public and Semi-Public	66	6	148
Farmsteads	32	99	0
Total	6,033	807	5,519

STRUCTURAL INVENTORY

Land use within the flood plains were determined by aerial photographs and visual inspections. Here is a list of the following general uses: residential, commercial, industrial, public and semi-public, and agricultural. Foundation heights, number of stories, and structures quality were noted.

Residential- one and two story single family homes, duplexes, apartments, condominiums and mobile homes. Losses include structures, contents, and yard area damages.

Farmsteads- Farm houses and farm buildings (barns and sheds) and their contents.

Commercial Shopping centers, office and warehouses, retail outlets, motels, and restaurants include structures, fixtures, and inventory.

Industrial Processing and packaging plants, and include structures and contents.

Agricultural Crop damage and loss, irrigation system repair land clean up and leveling, etc.

Public & Semi-Public- Schools, hospitals, public organizations, offices, police and fire stations, utilities and churches and include structure and contents.

The U.S.G.S. quadrant maps, and Yuba County Assessors maps that depicted specific flood plains were used for this study. After discussions with local real estate personnel and planners it was decided that very little growth or change is expected to occur in the flood plain.

VALUE OF DAMAGEABLE PROPERTY

The value cf structures were based upon the Yuba County Assessors Rolls and discussions with local realtors and County Assessor officials. A Lotus (1-2-3 for windows) spreadsheet was formatted for calculation purposes. A comparison of values between Assessor Roles and the Yuba County realtors were used as the uncertainty parameters for the Economics @ Risk Program. On site inspections of all properties were made to determine condition, the number of stories, and to estimate the foundation heights to help in the determination of first floor elevations. Two foot contour maps with spot elevations were also used to help estimate first flood elevations. The standard deviation used for the first floor elevation variance concur with EC 1105-2-205 for use with 2 foot contour maps, or 0.6 feet.

Residential content values came from the content to structure value shown in EC 1105-2-205. These values are not projected to grow. For other structure classifications, the value of content percentages were based upon information gathered from other district studies and from personal interviews with realtors. Based upon past district studies, these content percentages are considered appropriate for the Yuba River Basin study area. Future growth was not considered for this analysis. The total depreciated value of property for all flood plain structures and contents under existing conditions are shown in **Table 3**.

TABLE 3
400-Year Flood Plain
Value of Property
7 1/8% Interest Rate
October 1997 Prices
Reaches 1, 2 & 3
($1,000)

REACH 1	STRUCTURE	CONTENTS
Residential	$201,431	$101,415
Commercial	$18,683	18,683
Industrial	$20,810	20,810
Public & Semi-public	43,323	21,662
Farmsteads	322	174
Total	$285,000	$163,000

REACH 2	STRUCTURE	CONTENTS
Residential	$47,360	22,435
Commercial	305	305
Industrial	46,185	46,185
Public & Semi-public	7,790	3,895
Farmsteads	16,113	7,746
Total	118,000	81,000

REACH 3	STRUCTURE	CONTENTS
Residential	$307,259	$133,383
Commercial	87,878	87,878
Industrial	14,918	14,918
Public & Semi-public	157,026	78,513
Farmsteads	0	0
Total	$567,000	315,000

EMERGENCY COSTS

Emergency costs were based upon the number of people affected by the flood and the estimated amount of time it would take before residents returned to their homes. Costs were estimated at $12 per person per day until the home could be reoccupied. Evacuation ranges from sixty days for homes inundated by several feet above the first floor to several days for neighborhoods with minor flooding.

The State of California, Department of Finance Office population estimates were used in computing emergency costs. To calculate emergency cost the number of housing units in each flood plain is multiplied by the number of persons per house by the cost per day by the duration.

AUTOMOBILES DAMAGES

The depth-damage relationship derived by the Soil Conservation Service in 1983 for the Lower Creek Watershed was used to estimate damages to automobiles. Auto damages were based on an estimate of the total number of automobiles in each flood plain hazard zone. The damages were verified by comparing data gathered on other District Studies (Napa River, Magpie Creek and Battle Mountain). Based on discussions with insurance companies, it was determined that the typical household had 1.7 automobiles. The total number of automobiles in each flood plain was estimated by multiplying 1.7 by the number of households in each flood plain. It was assumed that 50 percent of the automobiles would be damaged during a flood event. The estimated number of cars was multiplied by the average-value of an automobile ($6,700) to determine the value of all automobiles in the flood plain.

ROAD DAMAGES

Road damages were estimated by measuring the total miles of road in each flood plain at various depths of flooding and then applying the applicable dollar-damage per mile value for each depth. There were three types of roads: dirt, two-lane paved, and four-lane paved.

TRAFFIC DISRUPTION

No damages were estimated for highway traffic disruption. While flooding could cause the closure or delays of highway 65 and 70, damage values were found to be insignificant. (Daily traffic counts were obtained from the California Department of Transportation and were used to estimate the number of potential automobile trips involved for a detour).

AGRICULTURAL DAMAGES

Agricultural crop damage determination involves a different methodology. For instance, damages, depths, and duration are measured against the damage that would occur to a certain crop during a particular month. Monthly damages are dependent on production costs expended at the time of flooding, and the possibility that flooding destroys the crop and consideration of a chance to replant the same or different appropriate crop.

STRUCTURE AND CONTENT DAMAGE

Flood damages to structures have been estimated for all structures types and their contents. The calculation of flood damages for each structure is dependent on its replacement cost less depreciation, its content value, its physical characteristics and condition, and the elevation of the structure in relation to the water surface elevation for given flood events. Calculation of structural and content damage was performed with the use of Corps of Engineers (I.W.R) Economics @ Risk Simulation Model. This model was modified by the Vicksburg District to work with nonparallel flood profiles. Because of the nonparallel flood profiles, an assortment of average depth for each of the three reaches were applied as inputs to modified Economic @ Risk program. The model calculates economic damages that would occur given a series of simulated flood events. The model's internal depth/damage curves for structures were established using curves that were based primarily on the 1988 F.E.M.A. curves, and from curves by the Tennessee Valley Authority study prepared for the Department of Housing and Urban Development in December 1969. These curves were used for residential, commercial, industrial, and public & semi-public structures and contents. These curves were revised to account for extreme depths (of 15 feet and greater) in Reach 2 (RD 784)and Reach 3 (Marysville). Due to extreme depths an adjustment was

made to the Economic @ Risk program. Percent damage content was revised to represent a more logical hydrology and economic assumption.

RESULTS OF THE ECONOMIC @ RISK PROGRAM

The depth/damage curves used in the Yuba River Basin study were modified to account for intense depths in Reach 2 (RD 784) which range from 15 feet to 22 feet, and in Reach 3 (Marysville) depths average 18.7 feet. In addition, a stage-damage curve was created for each reach by adding all land use damages together by frequency and looking up the corresponding stage. Also added to the total curve were the damage categories that did not require a standard deviation. These are land use categories that do not have a first floor elevation, a structure or a content value. These include road damage, emergency costs, and auto damage. This stage-damage curve, along with the frequency-discharge, and stage discharge curves was use as input for the Hydrologic Engineering Center (H.E.C) Monte program. No savings in flood insurance program benefits were taken since the analysis assumed no future growth in the flood plain beyond the base year.

ECONOMIC UNCERTAINTIES

Variations in structure values were based on a range of values determined by comparing two different valuation methods: Assessor data and realtor data. These two values for each sample structure were used to estimate the standard deviation. Uncertainties in first floor elevation were based on available topographic information. Two foot contours were used for Reaches 1, 2 and 3. Variation of residential content value was based on results from other studies, and FIA data.

TABLE 4a
Stage- Damage Curve - Existing Conditions
7 1/8% Interest Rate
Damages in $ millions
October 1997 prices

Flood Plain (Exceedance Probability)	Flood Event	Stage in feet	Damages Structure & Content	Damages Agriculture	Damages Autos, Emergency & Roads	Damages Total
AREA 1 - OLIVEHURST Index Point #1 (YR #4) RIVER MILE 2.75						
Non- Damage						
0.014		77.0	0.0	0.0	0.0	0.0
0.005	200 Year	78.8	94.8	1.8	25.0	121.6
0.0025	400 Year	81.8	140.3	3.7	32.6	176.6
0.001	Max	82.1	140.3	3.7	32.6	176.6
AREA 2 - RD #784 Index Point #2 (FR #7) RIVER MILE 17						
Non- Damage						
0.042		59.0	0.0	0.0	0.0	0.0
0.005	200 Year	61.9	93.6	7.8	5.5	106.9
0.0025	400 Year	65.7	93.6	7.8	5.5	106.9
0.001	Max	65.9	93.6	7.8	5.5	106.9
AREA 3 - MARYSVILLE Index Point #3 (YR #1) RIVER MILE 1						
Non- Damage						
0.0075		75.0	0.0	0.0	0.0	0.0
0.0049	200 Year	76.0	567.1	0.0	28.2	595.3
0.0037	300 Year	78.2	567.1	0.0	29.1	596.2
0.0025	400 Year	80.3	567.1	0.0	30.0	597.1
0.001	Max	82.1	567.1	0.0	30.0	597.1

REVISED - SEPTEMBER 1998

STAGE-DAMAGE CURVE

Damages for all categories (structure & content, roads, auto and emergency) were calculated for various events based on water surface elevation. Damage results were linked to stage elevations based on frequency and tied to three index points for the risk-based analysis. The stage-damage curves for Reach 1 (Olivehurst and Linda), Reach 2 (RD 784) and Reach 3 (Marysville) are shown in **Tables 4, 5 and 6.**

TABLE 4
Stage-Damage Curve
Reach 1 (Olivehurst)
7 1/8% Interest Rate
October 1997 Prices
Damages in $1,000

INDEX POINT #1 (YR#4) RIVER MILE 2.75

Original Floodplain	Stage in Feet	Damages Total	Standard Deviation
Non-Damage	77	0	0
200 Year	78.8	$120,000	5026
400 Year	81.8	$177,000	5945
1000 Year	82.1	$177,000	5945

TABLE 5
Stage-Damage Curve
Reach 2 (RD 784)
7 1/8% Interest Rate
October 1997 Prices
Damages in $1,000

INDEX POINT #2 (FR#7) RIVER MILE 17

Original Floodplain	Stage in Feet	Damages Total	Standard Deviation
Non-Damage	59	$107,000	5304
200 Year	61.9	$107,000	5304
400 Year	65.7	$107,000	5304
1000 Year	65.9	$107,000	5304

TABLE 6
Stage- Damage Curve
Reach 3 (Marysville)
7 1/8% Interest Rate
October 1997 Prices
Damages in $1,000

INDEX POINT #3 (YR#1) RIVER MILE 1

Original Floodplain	Stage in Feet	Damages Total	Standard Deviation
Non-Damage	75	0	0
200 Year	76	$595,000	37589
400 Year	80.3	$597,000	37589
1000 Year	82.1	$597,000	37589

AVERAGE ANNUAL DAMAGES

Average annual damages are the expected value of flood damages for a given economic position and point in time. Using the MONTE Carlo simulation, expected annual damages (EAD) are computed as the average of the sum of all damages from the simulations performed.

Probable average annual damages for with and without project conditions were estimated for a project life of 50 years, using a 7 1/8 percent interest rate and October 1997 prices.

Hydrology and hydraulic inputs (discharge-frequency, stage-discharge and PNP's and PFP's) were incorporated in the MONTE program along with the stage-damage curves from Tables . The results of the without-project and with project expected annual damages were computed for several levels of protection (1/ probable exceedance) by changing the stage elevations for PNP AND PFP. The results for Reaches 1, 2 & 3 are shown in **Tables 7, 8 & 9.**

TABLE 7
Expected Annual Damages
Reach 1
Without and With Project
7 1/8% Interest Rate
October 1997 Prices
($ 1,000)

Probable Exceedance	Level Protection (1/prob.exceed)	Without Project	With Project	Benefits
0.0156	64.1	2,463	2,463	0
0.0089	112.4	2,463	1,550	913
0.0064	156.3	2,463	1,128	1,335
0.0048	208.3	2,463	841	1,622

TABLE 8
Expected Annual Damages
Reach 2
Without and With Project
7 1/8% Interest Rate
October 1997 Prices
($ 1,000)

Probable Exceedance	Level Protection (1/prob.exceed)	Without Project	With Project	Benefits
0.0065	153.8	695	695	0
0.0043	232.5	695	465	230
0.0033	303	695	355	340
0.0025	400	695	263	432

TABLE 9
Expected Annual Damages
Reach 3
Without and With Project
7 1/8% Interest Rate
October 1997 Prices
($ 1,000)

Probable Exceedance	Level Protection (1/prob.exceed)	Without Project	With Project	Benefits
0.0095	105.3	5,641	5,641	0
0.0064	156.3	5,641	3,832	1,809
0.0048	208.3	5,641	2,840	2,801
0.0035	285.7	5,641	2,114	3,527
0.0029	344.8	5,641	1,725	3,916
0.0024	416.7	5,641	1,418	4,223
0.0017	588.2	5,641	1,012	4,629
0.0015	666.7	5,641	919	4,722

AVERAGE ANNUAL BENEFITS

The average annual flood reduction benefits are the difference between the average annual equivalent flood damage (losses) without the project and the residual average annual equivalent flood damage (losses) with the project.

YUBA RIVER FEASIBILITY STUDY

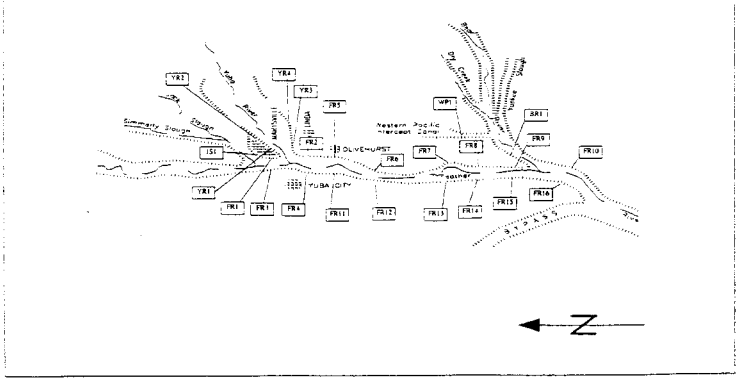
Risk and Uncertainty Results (Yuba City Side)

5-Aug-96

	Index Point				Base (w/Betterment)*			Yuba City 100-Year			Exact PNP Mitigation			
ID	RM	LM	TOL	LEVEE	PNP	PFP	TE	PNP	PFP	TE	PNP	PFP	Raise	TE
LINDA-OLIVEHURST														
YR4	2.75	2.75	83.2	Left	80.5	81.5	122	80.5	81.5	122				
YR3	1.5	1.15	81.2	Left	78.1	79.1	111	78.1	79.1	107	78.4	79.4	0.3	111
FR2	26.65	24.9	78.5	Left	76.5	77.5	111	76.5	77.5	106	76.7	77.5	0.2	111
FR5	24	22.4	75.2	Left	71.6	74.6	126	71.6	74.6	120	71.9	74.6	0.3	126
LOWER RD 784														
FR6	21	19.4	68.7	Left	66.2	69.2	133	66.2	69.2	128	66.4	69.2	0.2	133
FR7	17	16.2	64.7	Left	62	64	112	62	64	106	62.3	64	0.3	112
FR8	15	14.3	63	Left	57.8	60.8	625	57.8	60.8	500	58.3	60.8	0.5	625
FR9	13	12.6	59.1	Left	54.5	57.5	1000	54.5	57.5	714	55.1	57.5	0.6	1000
BR1	2	1.7	59	Right	55.5	58.5	1666	55.5	58.5	1250	56	58.5	0.5	1666
WP1	1	1	62.2	Right	57.8	60.8	1250	57.8	60.8	909	58.7	60.8	0.9	1250
MARYSVILLE														
JS1	1.4	0.95	84.4	Left	78.4	81.4	130	78.4	81.4	123	78.7	81.4	0.3	130
FR1	28.85	26.9	85.9	Left	77.7	80.7	116	77.7	80.7	112	78	80.7	0.3	116
YR1	1.6	1	85.5	Right	77.15	81.15	123	77.15	81.15	117	77.4	81.15	0.3	123
YR2	3.1	2.5	86.4	Right	79	83	123	79	83	123				
YUBA CITY														
FR3	28.85	19.8	81.8	Right	77.7	80.7	116	77.7	80.7	112	78	80.7	0.3	116
FR4	26.65	17.6	79.5	Right	74.8	77.8	81	76.5	77.8	100				
MITIGATION - RIGHT BANK FEATHER RIVER														
FR11	24	14.6	77	Right	71.6	73.6	105	71.6	73.6	101	71.8	73.6	0.2	105
FR12	21	11.7	70	Right	66.2	68.2	109	66.2	68.2	105	66.4	68.2	0.2	19
FR13	17	8.6	65.8	Right	62	64	112	62	64	106	62.3	64	0.3	112
FR14	15	6.7	63	Right	57.8	59.8	454	57.8	59.8	384	58.2	59.8	0.4	454
FR15	13	4.9	62.8	Right	54.5	58.5	1250	54.5	58.5	833	55.2	58.5	0.7	1250
FR16	9.2	1.5	54.6	Right	50	54	1666	50	54	1000	50.5	54	0.5	1666
MITIGATION - LEFT BANK FEATHER RIVER														
FR10	1	1	62.2	Right	50	52	833	50	52	555	50.7	52	0.7	833

* - Right Bank Feather Failures at Existing PNP

INDEX MAP



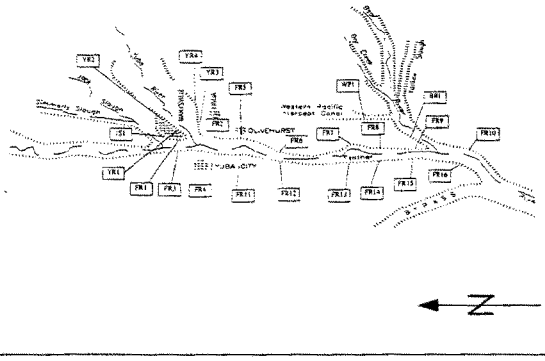
REVISED - SEPTEMBER 1998

YUBA RIVER FEASIBILITY STUDY

Risk and Uncertainty Results - Exact Betterment Mitigation

Index Point					Base			Betterment						
								Computed			Exact PNP Mitigation			
ID	RM	LM	TOL	LEVEE	PNP	PFP	TE	PNP	PFP	TE	PNP	PFP	Raise	TE
LINDA-OLIVEHURST														
YR4	2.75	2.75	83.2	Left	78	80	63	80.5	81.5	100				
YR3	1.5	1.15	81.2	Left	77.1	79.1	87	78.1	79.1	100				
FR2	26.65	24.9	78.5	Left	74.8	76.8	70	76.5	77.5	100				
FR5	24	22.4	75.2	Left	71.6	74.6	123	71.6	74.6	120	71.7	74.5	0.1	123
LOWER RD 784														
FR6	21	19.4	68.7	Left	66.2	69.2	133	66.2	69.2	128	66.4	69.2	0.2	133
FR7	17	16.2	64.7	Left	62	64	111	62	64	107	62.2	64	0.2	111
FR8	15	14.3	63	Left	57.8	60.8	588	57.8	60.8	526	58.1	60.8	0.3	588
FR9	13	12.6	59.1	Left	54.5	57.5	833	54.5	57.5	714	54.8	57.5	0.3	833
BR1	2	1.7	59	Right	55.5	58.5	1666	55.5	58.5	1428	56	58.5	0.5	1666
WP1	1	1	62.2	Right	57.3	60.8	3333	57.8	60.8	2500	58.3	60.8	0.5	3333
MARYSVILLE														
JS1	1.4	0.95	84.4	Left	78.4	81.4	126	78.4	81.4	123	78.5	81.4	0.1	126
FR1	28.85	26.9	85.9	Left	77.7	80.7	114	77.7	80.7	112	77.9	80.7	0.2	114
YR1	1.6	1	85.5	Right	77.15	81.15	122	77.15	81.15	117	77.3	81.15	0.15	122
YR2	3.1	2.3	86.4	Right	79	83	125	79	83	122	79.1	83	0.1	125
MITIGATION - RIGHT BANK FEATHER RIVER														
FR3	28.85	19.8	81.8	Right	77.7	80.7	114	77.7	80.7	112	77.9	80.7	0.2	114
FR4	26.65	17.6	79.5	Right	74.8	77.8	88	74.8	77.8	86	74.9	77.8	0.1	88
FR11	24	14.6	77	Right	71.6	73.6	104	71.6	73.6	101	71.8	73.6	0.2	104
FR12	21	11.7	70	Right	66.2	68.2	109	66.2	68.2	105	66.4	68.2	0.2	109
FR13	17	8.6	65.8	Right	62	64	111	62	64	107	62.2	64	0.2	111
FR14	15	6.7	63	Right	57.8	59.8	454	57.8	59.8	384	58.2	59.8	0.4	454
FR15	13	4.9	62.8	Right	54.5	58.5	1000	54.5	58.5	833	54.7	58.5	0.2	1000
FR16	9.2	1.5	54.6	Right	50	54	1428	50	54	1250	50.2	54	0.2	1428
MITIGATION - LEFT BANK FEATHER RIVER														
FR10	9.2	1	62.2	Left	50	52	833	50	52	666	50.3	52	0.3	833

INDEX MAP



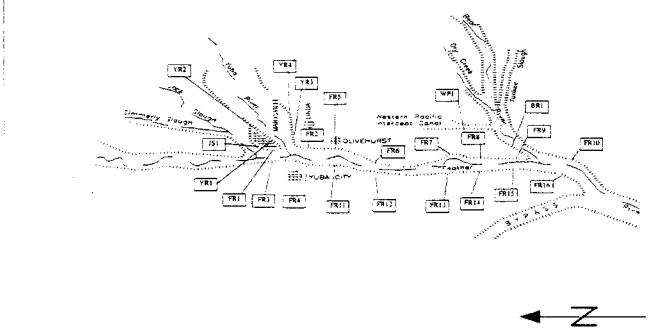
REVISED - SEPTEMBER 1998

YUBA RIVER FEASIBILITY STUDY

Risk and Uncertainty Results - 200Yr Exact Project Mitigation

Index Point					Base			200-Year Project						
								Computed			Exact PNP Mitigation			
ID	RM	LM	TOL	LEVEE	PNP	PFP	TE	PNP	PFP	TE	PNP	PFP	Raise	TE
LINDA-OLIVEHURST														
YR4	2.75	2.75	83.2	Left	78	80	63	82.5	83.5	200				
YR3	1.5	1.15	81.2	Left	77.1	79.1	87	80.6	81.6	200				
FR2	26.65	24.9	78.5	Left	74.8	76.8	70	79	80	200				
FR5	24	22.4	75.2	Left	71.6	74.6	123	74.5	75.5	200				
LOWER RD 784														
FR6	21	19.4	68.7	Left	66.2	69.2	133	68.5	69.5	200				
FR7	17	16.2	64.7	Left	62	64	111	64.5	65.5	200				
FR8	15	14.3	63	Left	57.8	60.8	588	57.8	60.8	357	59.8	60.8	1.0	588
FR9	13	12.6	59.1	Left	54.5	57.5	833	54.5	57.5	476	56.5	57.5	2.0	833
BR1	2	1.7	59	Right	55.5	58.5	.666	55.5	58.5	833	57.5	58.5	2.0	1666
WP1	1	1	62.2	Right	57.8	60.8	3333	57.8	60.8	2000	58.8	60.8	1.0	3333
MARYSVILLE														
JS1	1.4	0.95	84.4	Left	78.4	81.4	126	81.4	82.4	200				
FR1	28.85	26.9	85.9	Left	77.7	80.7	114	81	82	200				
YR1	1.6	1	85.5	Right	77.15	81.15	122	80.7	81.7	200				
YR2	3.1	2.5	86.4	Right	79	83	125	82.5	83.5	200				
MITIGATION - RIGHT BANK FEATHER RIVER														
FR3	28.85	19.8	81.8	Right	77.7	80.7	114	77.7	80.7	104	78.4	80.7	0.7	114
FR4	26.65	17.6	79.5	Right	74.8	77.8	88	74.8	77.8	81	75.5	77.8	0.7	88
FR11	24	14.6	77	Right	71.6	73.6	104	71.6	73.6	93	72.1	73.6	0.6	104
FR12	21	11.7	70	Right	66.2	68.2	109	66.2	68.2	96	66.8	68.2	0.6	109
FR13	17	8.6	65.8	Right	62	64	111	62	64	98	62.4	64	0.4	111
FR14	15	6.7	63	Right	57.8	59.8	454	57.8	59.8	277	59.1	60.3	0.5	454
FR15	13	4.9	62.8	Right	54.5	58.5	1000	54.5	58.5	526	56.2	58.5	0.7	1000
FR16	9.2	1.5	54.6	Right	50	54	1428	50	54	769	51.5	54	1.5	1428
MITIGATION - LEFT BANK FEATHER RIVER														
FR10	9.2	1	62.2	Left	50	52	833	50	52	454	51.2	52.2	1.2	833

INDEX MAP



REVISED - SEPTEMBER 1998

FINAL
ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT
YUBA RIVER BASIN INVESTIGATION
CALIFORNIA

April 1998

Type of Statement. Final Environmental Impact Statement/Final Environmental Impact Report (FEIS/FEIR).

Lead Agency. U.S. Army Engineer District, Sacramento.

Non-Federal Sponsor. State of California Reclamation Board. State Clearinghouse #92123076.

Proposed Action. The U.S. Army Corps of Engineers and the non-Federal sponsor propose to increase flood protection to the lower Yuba River basin, part of the Feather River basin below Oroville Dam, and the city of Marysville by (1) raising levees, constructing or modifying berms and drains, and installing or modifying slurry walls along sections of the Yuba and Feather Rivers and (2) installing slurry walls along the ring levee around the city of Marysville.

Abstract. This FEIS/FEIR describes the affected environment along the lower Yuba River and sections of the Feather River; evaluates the direct, indirect, and cumulative environmental effects and evaluates benefits of the selected plan and two alternative plans; and recommends mitigation measures. Most effects would be either short term or would be avoided using best management practices. Adverse effects on vegetation and wildlife and endangered species would be mitigated to a level of insignificance by developing new habitat areas.

For Further Information: District Engineer
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(916) 557-6715
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YUBA RIVER BASIN INVESTIGATION, CALIFORNIA
FINAL ENVIRONMENTAL IMPACT STATEMENT/REPORT (EIS/EIR)

SUMMARY

PURPOSE OF STUDY AND EIS/EIR

This study evaluates the feasibility and Federal interest in providing increased flood protection to the lower Yuba River basin, part of the Feather River basin below Oroville Dam, and the city of Marysville. The EIS/EIR describes the existing resources in the study area, evaluates the effects of the proposed alternative plans on these resources, and develops mitigation measures to avoid, minimize, or offset any adverse effects.

STUDY AREA

The study area is part of the larger Yuba River basin and Feather River basin below Oroville Dam. The basins extend from the Sacramento Valley to the Sierra Nevada. Streams in the mountains flow west, join the Yuba and Feather Rivers and their tributaries, and flow into the Sacramento River. The study area lies within Yuba County and includes the cities of Marysville, Linda, and Olivehurst. Construction is proposed along three reaches: reach 1 - Yuba River/Feather River, reach 2 - Feather River, and reach 3 - Marysville ring levee (see Figure 1).

NEED FOR ACTION

The history of flooding in the study area shows that there is an ongoing flood threat to lives and property. The basins are subject to periods of intense rainfall and runoff events, and during the spring the runoff may be augmented by snowmelt, especially during warm rain storms. High runoff peaks and combined river and tributary flows stress existing levees and flood control systems. Levee breaks can happen unexpectedly, and floodwaters can inundate adjacent areas quickly and with little warning. Recent flooding in 1950, 1955, 1964, 1986, and 1997 damaged residences, businesses, and agricultural land, disrupted transportation and public facilities, and resulted in loss of lives.

PRELIMINARY ALTERNATIVES

Initially, a variety of structural and nonstructural preliminary alternatives were formulated and evaluated using technical, economic, and environmental criteria. Alternatives that failed to meet the project's flood control goals or had excessive costs or adverse environmental effects were eliminated from further consideration. The only preliminary alternative found to be feasible was to modify

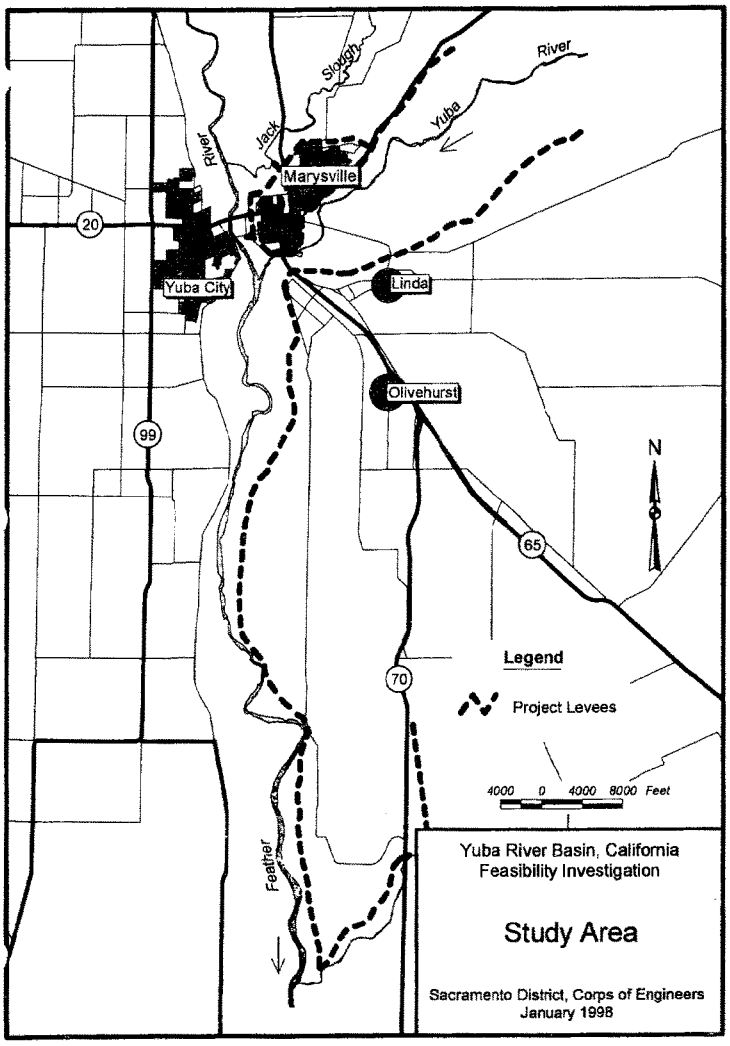
Slough
River
Jack
River
Yuba
Marysville
20
Yuba City
Linda
Olivehurst
99
N
65
70
Legend
Project Levees
4000 0 4000 8000 Feet
Feather
Yuba River Basin, California
Feasibility Investigation
Study Area
Sacramento District, Corps of Engineers
January 1998

Figure 1

existing levees by raising, constructing or modifying berms and drains, and installing or modifying slurry walls.

ALTERNATIVES

Using a risk-based approach, two alternatives were formulated to reduce flooding and flood damage in the study area. This risk-based approach used three index areas - each with similar hydrologic, hydraulic, and economic characteristics - in the formulation. Construction methods were combined to provide targeted levels of flood protection in each reach. The objectives, main features, and accomplishments of the three alternatives (including no action) are summarized below. Some of the work has been completed as advance work under Phase II of the Sacramento River Flood Control System Evaluation project.

Alternative 1 (No Action)

The no-action alternative describes the without-project conditions and is the baseline for the environmental analysis. This alternative assumes that there would be no Federally funded flood control improvements in the study area. Flooding would continue due to high runoff and combined river and tributary flows which stress existing levees and flood control systems. Flooding would damage residences, businesses, agricultural land and crops, and transportation and public facilities, and could cause loss of life.

Alternative 2 (NED Plan)

Objective

This alternative was formulated to maximize net benefits (economic benefits minus project costs) and is the most cost-effective plan.

Features

- Deepen slurry wall, install slurry wall, raise levee, raise levee with berm and drain, modify berm and drain, and construct berm and drain on sections of east bank of Yuba River.
- Deepen slurry wall, install slurry wall, raise levee, modify berm and drain, and raise berm on sections of east bank of Feather River.
- Install slurry wall and construct berm on waterside sections of Marysville ring levee.

Accomplishments

- Protect reach 1 from a 1 in 250 annual event.
- Protect reach 2 from a 1 in 200 annual event.
- Protect reach 3 from a 1 in 300 annual event.

Alternative 3

Objective

This alternative was formulated to slightly reduce the level of flood protection in reach 1 on the NED plan. Most of the features are the same as Alternative 2 except that the heights, widths, and depths in reach 1 are less.

Features

- Deepen slurry wall, install slurry wall, raise levee, modify berm and drain, and construct berm and drain on sections of east bank of Yuba River.
- Deepen slurry wall, raise levee, modify berm and drain, and raise berm on sections of east bank of Feather River.
- Install slurry wall and construct berm on waterside sections of Marysville ring levee.

Accomplishments

- Protect reaches 1 and 2 from a 1 in 200 annual event.
- Protect reach 3 from a 1 in 300 annual event.

AFFECTED ENVIRONMENT

Environmental resources not affected by the project alternatives include climate, topography, geology and soils, prime and unique farmlands, water quality, fisheries, socioeconomics, recreation and esthetics, and hazardous, toxic, and radiological waste. Significant resources that may be affected by the project include land use, transportation, noise, air quality, vegetation and wildlife, special status species, and cultural resources.

ENVIRONMENTAL EFFECTS AND MITIGATION

Table 1 summarizes the adverse environmental effects of the three alternatives on the significant resources identified in the previous paragraph. Those resources that would experience significant short- or long-term effects and require mitigation measures beyond best management practices include vegetation and wildlife, and special status species. Table 2 summarizes the mitigation measures to avoid, minimize, or compensate for the adverse effects of Alternatives 2 and 3.

ENVIRONMENTAL COMMITMENTS

Environmental commitments are the mitigation measures or design/operational actions incorporated into the project to avoid, minimize, or compensate for significant environmental effects. Table 3 shows a list of the environmental commitments for the Yuba River basin study. The list would be included in a final mitigation and monitoring plan completed during the plans and specifications phase of the project.

COMPLIANCE WITH APPLICABLE LAWS, POLICIES, AND PLANS

The project will comply with all Federal laws, regulations, and Executive orders when the endangered species consultation, cultural resources surveys and coordination, have been completed. In addition, the non-Federal sponsor will comply with all State and local laws and permit requirements.

MAJOR CONCLUSIONS AND FINDINGS

The alternatives would have adverse effects on environmental resources in the project area. However, most effects would either be short term or would be avoided using best management practices. Adverse effects on vegetation and wildlife and special status species would be mitigated to less-than-significant levels by developing new habitat areas. A mitigation and monitoring plan is included in the EIS/EIR.

PUBLIC INVOLVEMENT

Public concerns focused on increasing flood protection to the areas south of the Yuba River and east of the Feather River. These issues were discussed with the non-Federal sponsor, other agencies, and local interests. The Corps considered this issue when identifying resources and evaluating the environmental effects of the alternatives.

The draft EIS/EIR was released for public and agency review in January 1998. A public hearing was held in March 1998. Comments from the public review and hearing were considered when the final environmental document was prepared. Copies of the comments and Corps responses are included in an appendix to the EIS/EIR.

UNRESOLVED ISSUES

There are no unresolved issues at this time.

SELECTED PLAN

Based on the results of the feasibility studies and coordination with the non-Federal sponsor, Alternative 3 has been identified as the Selected Plan.

Table 1. - Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3
Land Use	Future growth and land use changes would occur as described in City and County General Plans.	No change from current plans.	No change from current plans.
Transportation	Traffic volumes are expected to increase as projected in the City and County General Plans.	Temporary increases in trips, volumes, roadway safety hazards, parking, and traffic disruption during construction.	Temporary increases in trips, volumes, roadway safety hazards, parking, and traffic disruption during construction.
Noise	Noise levels would be the same as existing conditions.	Temporary increase in noise levels during construction.	Temporary increase in noise levels during construction.
Air Quality	Local emission rates would likely change with projected traffic volume increases.	Temporary increase in combustion, dust, and asphalt paving emissions during construction.	Temporary increase in combustion, dust, and asphalt paving emissions during construction.
Vegetation and Wildlife	Vegetation and wildlife resources are not expected change.	Temporary and permanent loss of grassland and agricultural land during construction. Permanent loss of 2.23 acres of woodland habitat.	Temporary and permanent loss of grassland and agricultural land during construction. Permanent loss of 2.23 acres of woodland habitat.
Special Status Species	Habitat for special status species is not expected to change.	Potential loss or disturbance of the following species or their habitat: giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle.	Potential loss or disturbance of the following species or their habitat: giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle.
Cultural Resources	No change in the project area.	No known adverse effects. Surveys would be done prior to construction.	No known adverse effects. Surveys would be done prior to construction.

Table 2.- Summary of Mitigation

Affected Environment	Alternative 2 (NED Plan)	Alternative 3
Land Use	No project effects to land use; therefore, no mitigation needed.	No project effects to land use; therefore, no mitigation needed.
Transportation	Temporary effects would be offset by best management practices.	Temporary effects would be offset by best management practices.
Noise	Temporary effects of construction noise would be reduced by best management practices.	Temporary effects of construction noise would be reduced by best management practices.
Air Quality	Air quality effects would be reduced by best management practices.	Air quality effects would be reduced by best management practices.
Vegetation and Wildlife	Mitigation would use available "credits" for 2.98 acres at the existing mitigation site for Phase II of the System Evaluation.	Mitigation would use available "credits" for 2.98 acres at the existing mitigation site for Phase II of the System Evaluation.
Special Status Species	Specific mitigation/avoidance measures are proposed for the giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle. Mitigation will be finalized during consultation with the U.S. Fish and Wildlife Service.	Specific mitigation/avoidance measures are proposed for the giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle. Mitigation will be finalized during consultation with the U.S. Fish and Wildlife Service.
Cultural Resources	No known effects until surveys are completed; no mitigation at this time.	No known effects until surveys are completed; no mitigation at this time.

Table 3: Summary of Environmental Commitments

Affected Environment	Environmental Commitment
Transportation	During project construction, mitigation measures as listed in Section 4.3.4 will be implemented to reduce project effects to less than significant. The mitigation includes measures for parking, roadway safety, and bicycle use.
Noise	During project construction, mitigation measures as listed in Section 4.4.4 will be implemented to minimize disruption to sensitive receptors. Noise-reduction devices on construction equipment will be used to reduce noise by an average of 5 to 10 A-weighted decibels.
Air Quality	Mitigation measures as listed in Section 4.5.4 will be implemented during construction to reduce the quantity of project-induced emissions.
Vegetation and Wildlife	Available "credits" for 2.98 acres will be used at the mitigation site for Phase II of the System Evaluation as described in Section 4.6.4.
Special Status Species	Mitigation for affected species and habitat will be done in accordance with biological opinions of the U.S. Fish and Wildlife Service and Department of Fish and Game. Potential mitigation measures are described in Section 4.7.4.

YUBA RIVER BASIN INVESTIGATION, CALIFORNIA
FINAL EIS/EIR

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ACRONYMS AND ABBREVIATIONS

AAHU	average annual habitat unit
ADT	average daily traffic volume
APE	Area of Potential Effect
CAR	Fish and Wildlife Coordination Act Report
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CO	carbon monoxide
Corps	Corps of Engineers
dB	decibel
dBA	A-weighted decibel
DFG	California Department of Fish and Game
EIR	environmental impact report
EIS	environmental impact statement
EPA	Environmental Protection Agency
° F	degrees Fahrenheit
FESA	Federal Endangered Species Act
FRAQMD	Feather River Air Quality Management District
FWS	U.S. Fish and Wildlife Service
HEP	habitat evaluation procedures
HTRW	hazardous, toxic, and radiological waste
HU	habitat unit
lb/day	pounds per day
LM	levee mile
LOS	level of service
MOA	Memorandum of Agreement
m.s.l.	mean sea level
NED	National Economic Development
NEPA	National Environmental Policy Act
NOx	nitrogen oxides
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
PED	preconstruction engineering and design
Phase II	second phase of the System Evaluation
PM_{10}	particulate matter, 10 microns in size
ppm	parts per million
ROG	reactive organic gases
SHPO	State Historic Preservation Officer
SR	State Route
State	State of California
System Evaluation	Sacramento River Flood Control System Evaluation
ug/m^3	micrograms per cubic meter
U.S.C.	United States Code

CHAPTER 1.0

PURPOSE AND NEED FOR THE ACTION

CHAPTER 1.0

PURPOSE AND NEED FOR THE ACTION

1.1 INTRODUCTION

The Yuba River Basin Investigation, California, addresses flooding problems in the Yuba River basin, part of the Feather River basin, and city of Marysville. This Environmental Impact Statement/Environmental Impact Report (EIS/EIR) summarizes the results of the feasibility phase of the Yuba River Basin Investigation, California. Chapter 1 includes the study authority, overview of the study area, and purpose and need for the action; and briefly describes the proposed action. Sections describing the decisions to be made based on this analysis and the organization of the EIS/EIR are also included.

1.2 STUDY AUTHORITY

This study was conducted under the authority of the Flood Control Act of 1962 (Public Law 87-874). A portion of this act is presented below:

> The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind or tidal effects, to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its territorial possessions, which include the following named localities: Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provisions of Title III of Public Law 85-500.

1.3 STUDY AREA LOCATION

The study area is located in western Yuba County about 50 miles north of Sacramento. The study area is part of the watersheds of the Yuba and Feather Rivers, which are included in the larger Sacramento River system in northern

California. These two rivers originate in the Sierra Nevada and generally flow southwest in the mountains and foothills and then south in the Central Valley. The rivers eventually join the Sacramento River, which drains into the San Francisco Bay and the Pacific Ocean.

The drainage area of the Yuba River is about 1,350 square miles, of which 480 square miles are above New Bullards Bar Dam on the North Yuba River. The Yuba River basin is drained by the North, Middle, and South Yuba Rivers, which join above Englebright Reservoir to form the main stem of the Yuba River. Daguerre Point Dam is an old debris dam located below Englebright Dam, and the Yuba River flows about 10 miles below Daguerre Point Dam and joins the Feather River at the city of Marysville. The Feather River drains about 3,600 square miles above Oroville Dam. Between the dam and Marysville/Yuba City, the Feather River drains about 370 square miles and flows south to its confluence with the Sacramento River. Other major tributaries to the Feather River below Oroville Dam include Honcut Creek and the Bear River.

Water resources development on the Yuba River includes New Bullards Bar Dam, Daguerre Point Dam, Englebright Dam, and numerous other reservoirs in the basin such as Lake Spaulding, Bowman Lake, Fordyce Lake, and Scotts Flat Lake. These projects were constructed for a variety of purposes including irrigation, power generation, flood control, recreation, and regulation and diversion of streamflows. Oroville Dam and Reservoir on the Feather River is part of the State Water Project and is operated for flood control and irrigation.

This study focuses on flooding problems in the lower Yuba River basin and part of the Feather River basin below Oroville Dam. A study area map is shown in Figure 1-1. The study area includes the Yuba River south levee between levee mile (LM) 10.0 and the river's confluence with the Feather River, the east levee of the Feather River from its confluence with the Yuba River south to LM 15.0, and the ring levee around Marysville. The major urban areas include Marysville, Linda, and Olivehurst. Construction is proposed along three reaches: Yuba River/Feather River, Feather River, and Marysville ring levee. A general description of each reach and nearby area is provided below.

Reach 1 - Yuba River/Feather River

The Yuba River/Feather River reach includes the south levee of the Yuba River, as well as the east levee of the Feather River from its confluence with the Yuba River south to LM 20.0 near Broadway. The nearby area includes the cities of Linda and Olivehurst, which are characterized mainly by residential development with limited commercial, industrial, public, and open space land uses.

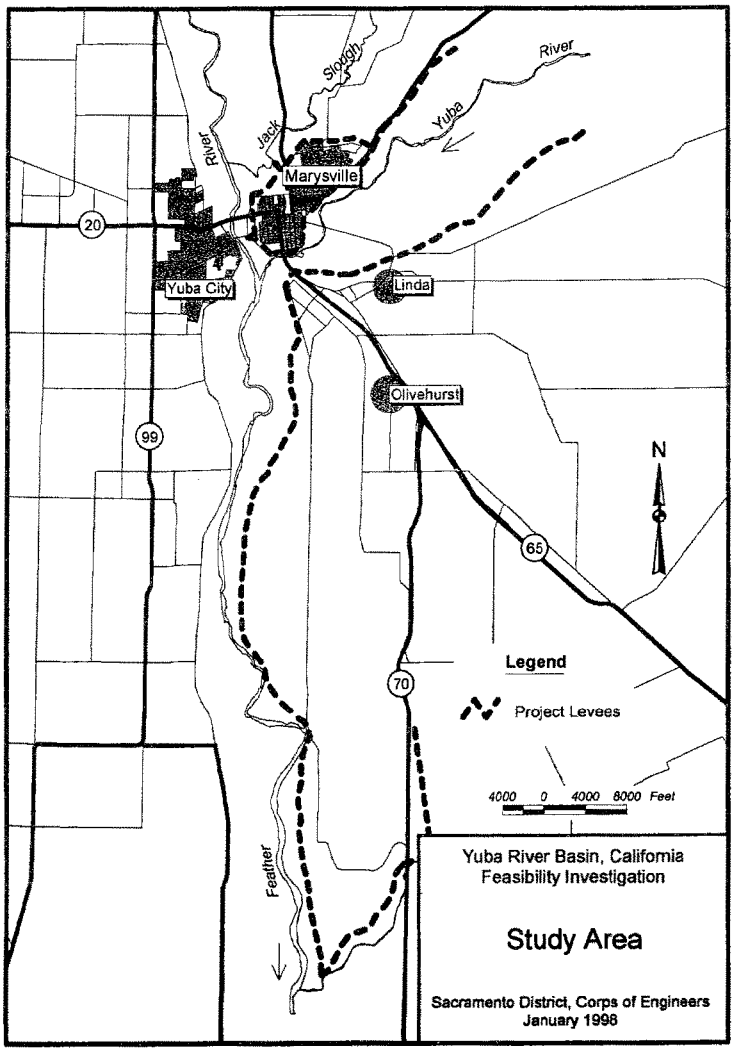

Slough
River
Jack
Yuba
River
Marysville
20
Yuba City
Linda
Olivehurst
99
N
65
70
Legend
Project Levees
4000 0 4000 8000 Feet
Feather
Yuba River Basin, California
Feasibility Investigation
Study Area
Sacramento District, Corps of Engineers
January 1998

Figure 1-1

Reach 2 - Feather River

The Feather River reach includes the east levee of the Feather River from LM 20.0 near Broadway to about LM 15.0. The nearby area is mainly agricultural with some limited industrial development.

Reach 3 - Marysville Ring Levee

The Marysville reach includes the area enclosed by the ring levee surrounding the city. Marysville is the Yuba County seat as well as the largest city in the county. Marysville is mainly residential with some commercial and industrial development.

1.4 PURPOSE AND NEED FOR THE ACTION

The U.S. Army Corps of Engineers and the State of California Reclamation Board, the non-Federal sponsor, are proposing to increase flood protection in the study area by installing or deepening slurry walls, deepening interior toe drains, constructing berms, and/or raising levees. Construction is scheduled to begin in 2000 and would be completed in two seasons, from April to November each year.

Historically, the Feather and Yuba Rivers experienced frequent overbank flooding in the winter and early spring. River channels were somewhat migratory, meandering and changing through time. In the mid-1800's, hydraulic mining began in the Mother Lode and was soon washing immense quantities of sediments into the rivers and streams. As the rivers and channels in the valley filled with sediments, channel capacity was reduced, and water flooded over the banks more often. In order to prevent flooding of Yuba City/Marysville and surrounding valley areas and to prevent damage from sediment, levees were constructed along the Feather and Yuba Rivers and their tributaries as part of the comprehensive Sacramento River Flood Control Project authorized in 1917.

Despite these levees protecting the study area, however, damaging floods still frequently occur. Recent floods have occurred on the Yuba and Feather Rivers in 1950, 1955, 1964, 1986, and 1997. In 1950, the south levee of the Yuba River broke near Hammonton, inundating 43,200 acres. The most damaging flood of record, in terms of loss of life and damages, was the flood of 1955. There was no upstream storage at this time, and simultaneous peaks occurred on both the Feather and Yuba Rivers. The west levee of the Feather River broke at Shanghai Bend, and the east levee broke near Nicolaus. About 100,000 acres of land were inundated, including 95 percent of Yuba City. Thirty-eight people were killed in the Yuba City area, and two were killed in the Nicolaus area.

The construction of the Oroville Dam and Reservoir in the 1960's helped to control flows on the Feather River and reduce flooding and flood damages. Flooding in 1964 inundated about 25,000 acres of agricultural land in the Feather River floodway and within the Yuba River levees. The 1986 event consisted of a closely spaced series of large rainstorms. Both Oroville and Bullards Bar Reservoirs were almost filled to flood storage capacity. While the Feather and Yuba Rivers were receding, the south levee of the Yuba River broke near Linda and Olivehurst. One person died, many people were injured, businesses were destroyed, and homes and businesses were damaged. In January 1997, a series of rainstorms lead to a levee break about 6 miles south of Olivehurst on the east levee of the Feather River. About 850 homes were flooded, and nearly 50,000 inhabitants of the area were evacuated. One person died during the flood. The levee broke in an area scheduled for levee rehabilitation work later that year.

The history of flooding in the Yuba City/Marysville area shows that there will continue to be an ongoing flood threat to lives and property. The basins are subject to periods of intense rainfall and runoff events, and during the spring the runoff may be augmented by snowmelt, especially during warm rain storms. High runoff peaks and combined river and tributary flows stress existing levees and flood control systems. Urban and agricultural areas in the study area are at risk of levee failure, flooding, and damage to residences, businesses, and crops. Levee breaks can happen unexpectedly, and floodwaters can inundate adjacent areas quickly and with little warning. Potential flood depths range from less than a foot to over 20 feet, depending on the flows and location of the levee break. Despite existing flood protection provided by the Sacramento River Flood Control System, the area is still vulnerable to major flooding as demonstrated by the recent flood in January 1997.

1.5 PRIOR STUDIES AND ADVANCE WORK

Prior Federal flood control studies in the study area include the Sacramento River Flood Control System Evaluation (System Evaluation) which was initiated in 1987. This study evaluated the long-term integrity of the flood control system for the Sacramento River and its tributaries. The System Evaluation was authorized by the Energy and Water Development Appropriation Act of 1987 and was divided into five phases. Phase I and Phase II included the populated Sacramento Urban and Marysville/Yuba City areas, respectively. Construction of the first phase of the System Evaluation is complete. Phase II is currently being constructed, and the work is scheduled to be completed in 1998.

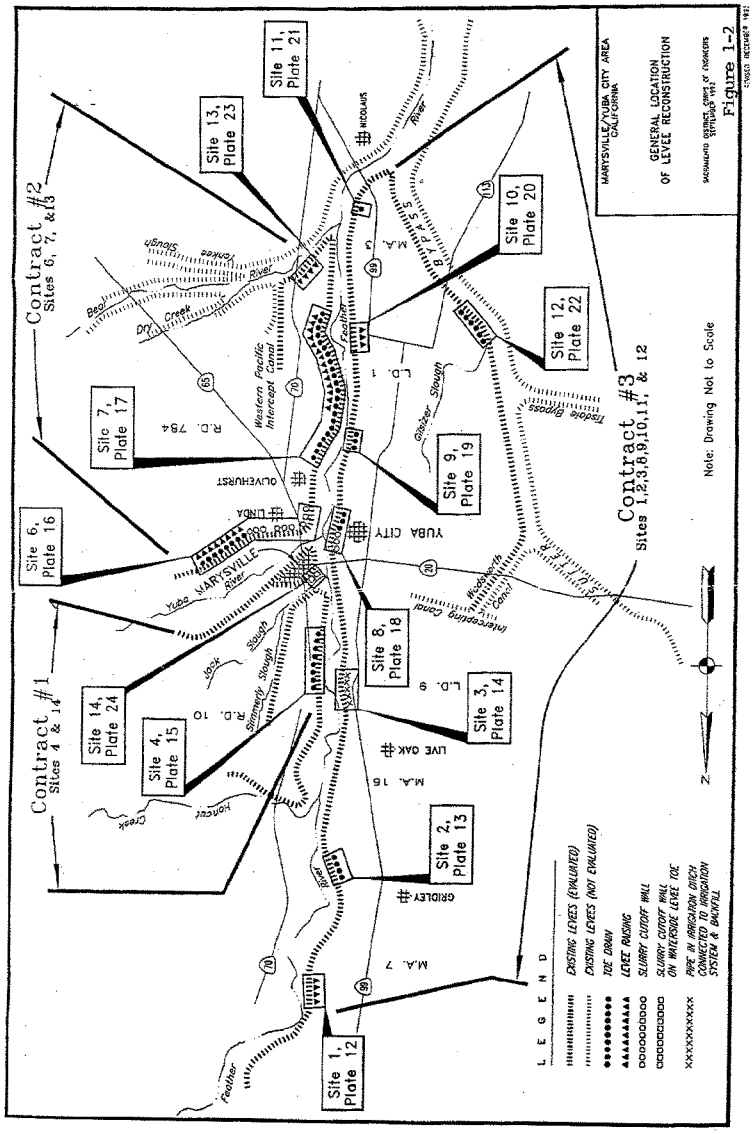
The results of the System Evaluation indicated that sections of the Sacramento River system project levees along the Feather and Yuba Rivers are susceptible to seepage problems and do not provide the design levels of flood

protection. The reconstruction work restores the authorized design level of flood protection (1 in 65 annual event) provided by project levees but does not increase this level of flood protection. Figure 1-2 shows the study area and levee reconstruction work associated with Phase II of the System Evaluation. Phase II reconstruction work includes levee raising, landside toe drains and/or berms, and slurry cutoff walls.

Since the study area and some of the proposed work for the Yuba River Basin Investigation overlap the study area and work sites for Phase II, several previous environmental documents for the Systems Evaluation are relevant to this EIS/EIR. In May 1992, the Sacramento River Flood Control System Evaluation, Phases II-V, Programmatic Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was completed for Phases II-V of the System Evaluation. A detailed environmental analysis was prepared for Phase II of the study in April 1993. The document was titled Sacramento River Flood Control System Evaluation Phase II - Marysville/Yuba City Area, Environmental Assessment/Initial Study and included a finding of no significant impact. Two supplemental environmental assessments for construction design changes were completed in 1997. The environmental assessments were titled Sacramento River Flood Control System Evaluation, Phase II - Marysville/Yuba City, Supplemental Environmental Assessment/Initial Study, and Sacramento River Flood Control System Evaluation, Phase II - Marysville/Yuba City Area, Construction for Contract 2B, Supplemental Environmental Assessment.

As provided in Section 104 of the Water Resources Development Act of 1986, local interests can apply for credit against their share of the design and construction cost of a project for work carried out after the reconnaissance phase as long as that work is consistent with the authorized plan. Two types of advance work are being constructed by the Corps in conjunction with work in Phase II of the System Evaluation. First, an increment of depth is being added to sections of new slurry wall along both rivers. Second, an increment of depth is also being added to sections of new drain along both rivers. The locations for this advance work are as follows:

- East levee of the Feather River - deepen 1.23 miles of slurry wall between LM's 24.79 and 26.02.
- South levee of the Yuba River - deepen 0.28 mile of slurry wall between LM's 0.00 and 0.28.
- South levee of the Yuba River - deepen 0.56 mile of slurry wall between LM's 1.23 and 1.79.


MARYSVILLE/YUBA CITY AREA
CALIFORNIA
GENERAL LOCATION
OF LEVEE RECONSTRUCTION
Figure 1-2
Contract #1
Sites 4 & 14
Contract #2
Sites 6, 7, & 13
Contract #3
Sites 1,2,3,8,9,10,11, & 12
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Site 2, Plate 13
Site 3, Plate 14
Site 4, Plate 15
Site 6, Plate 16
Site 7, Plate 17
Site 8, Plate 18
Site 9, Plate 19
Site 10, Plate 20
Site 11, Plate 21
Site 12, Plate 22
Site 13, Plate 23
Site 14, Plate 24
Yuba City
Marysville
Olivehurst
Linda
Live Oak
Gridley
Nicolaus
Feather River
Yuba River
Western Pacific Intercept Canal
Tisdale Bypass
Gilsizer Slough
Wadsworth Canal
Intercepting Canal
Jack Slough
Simmerly Slough
Honcut Creek
Dry Creek
Yankee Slough
Beal Slough
R.D. 784
R.D. 10
R.D. 9
L.D. 1
M.A. 3
M.A. 15
M.A. 7
Note: Drawing Not to Scale
LEGEND
EXISTING LEVEES (EVALUATED)
EXISTING LEVEES (NOT EVALUATED)
TOE DRAIN
LEVEE RAISING
SLURRY CUTOFF WALL
SLURRY CUTOFF WALL ON WATERSIDE LEVEE TOE
PIPE IN IRRIGATION DITCH CONNECTED TO IRRIGATION SYSTEM & BACKFILL

- South levee of the Yuba River - deepen 0.75 mile of slurry wall between LM's 24.79 and 26.02.
- South levee of the Yuba River - deepen 0.41 mile of drain between LM's 1.77 and 2.18.
- South levee of the Yuba River - deepen 0.84 mile of drain between LM's 2.92 and 3.86.
- East levee of the Feather River - deepen 3.04 miles of drain between LM's 20.04 and 23.08.
- East levee of the Feather River - deepen 0.63 mile of drain between LM's 15.86 and 16.49.

The implementation of this advance work is necessary because the nature of slurry wall and drain construction precludes future deepening, and this work is a feature in the flood control alternatives in the feasibility study. The non-Federal sponsor's application for potential credit for the Section 104 work was approved by the Assistant Secretary of the Army (Civil Works) by memorandum dated 4 October 1996. For economic and environmental analysis, this study assumes that this advance work would not be completed.

1.6 DECISIONS TO BE MADE BASED ON THIS ANALYSIS

The District Engineer, the commander of the Sacramento District of the Corps of Engineers, must decide whether or not to recommend that a plan described in this report be authorized for implementation as a Federal project, with modifications at the discretion of the Chief of Engineers.

1.7 ORGANIZATION OF THE EIS/EIR

The EIS/EIR is organized into six chapters. Chapter 2 discusses the plan formulation and selection and the alternatives considered for this project. Chapter 3 discusses the environment of the study area, and Chapter 4 discusses the effects of the proposed project on the affected environment and describes mitigation measures. Chapter 5 presents other chapters required in an EIS/EIR. Chapter 6 is the list of preparers; Chapter 7 lists references; and Chapter 8 is the index.

CHAPTER 2.0

ALTERNATIVES INCLUDING THE PROPOSED ACTION

CHAPTER 2.0

ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

This chapter describes project alternatives (potential action) and summarizes their environmental effects. The purpose of this chapter is to discuss the differences between the alternatives and summarize their environmental effects and mitigation.

2.2 PLAN FORMULATION AND SELECTION

Plan formulation is the process of developing and evaluating alternative plans to meet the needs and desires of society as expressed in specific planning objectives. This planning process is in accordance with the Federal Water Resources Council's Principles and Guidelines. Planning objectives and formulation criteria were used to develop project alternatives. The plan formulation process is explained in detail in Chapter 5 of the Feasibility Report.

2.3 ALTERNATIVES CONSIDERED BUT NOT STUDIED IN DETAIL

Initially, a variety of structural and nonstructural preliminary alternatives were formulated and evaluated using technical, economic, and environmental criteria. The alternatives described below were eliminated from further consideration because (1) they failed to meet the project flood control goals; (2) the costs exceeded the benefits; or (3) the associated environmental effects were excessive. The alternatives considered but not studied in detail are briefly described in the following sections. A complete description of these alternatives, analysis, and evaluation is included in Chapter 5 of the Feasibility Report.

2.3.1 Nonstructural

Most structural flood damage reduction alternatives are directed at the source of flooding. Their purpose is to change the direction of floodflows, decrease the area of inundation, alter the timing of floodflows, or store floodflows.

In contrast, nonstructural measures reduce flood damages by changing the use of the flood plain or by adapting existing uses to the flood hazard. Most nonstructural alternatives are directed at reducing the flood damages of individual property through land use restrictions and other actions. Nonstructural alternatives can include flood proofing, flood plain evacuation, development restrictions, and flood warning systems.

The following nonstructural measures were considered: relocating or elevating individual or groups of structures, flood plain zoning, flood warning systems, and preparedness planning. Preliminary analysis indicated that relocating or elevating structures would not be economically feasible because of the number of structures and the size of the flood plain. Flood plain zoning, flood warning systems, and preparedness planning would not decrease potential flooding; therefore, they were not considered further.

2.3.2 Large or Small Bypass

Diversion facilities move floodwaters from one segment of a river or bypass system to another by pumps, overflow weirs, bypass channels, or other diversion facilities. Two bypass diversion designs were examined. Both would use a diversion between Hammonton and Daguerre Point Dam. Excess floodflows would be conveyed down Reeds Creek to the Western Pacific Bypass (also known as Olive Drain and Best Slough) to the Bear River, emptying into the Feather River.

A large bypass was considered which would divert about 67,000 cubic feet per second from the Yuba River. The large bypass would require extensive and costly construction of levees, pumping plants, and bridge modifications. Analysis of the large bypass showed that construction costs exceeded the flood control benefits. As a result, this alternative was considered infeasible and was eliminated from further consideration.

A small bypass was considered which would use existing structures to pass about 15,000 cubic feet per second from a diversion point at Daguerre Point Dam into Reeds Creek through Best Slough and into the Bear River. Some additional levees and a low-flow channel would need to be constructed. Since the construction costs exceeded the flood control benefits, this alternative was considered infeasible and was eliminated from further consideration.

2.3.3 Reregulate Oroville and New Bullards Bar Reservoirs

Changing the operations of existing reservoirs by allocating more storage for flood control by reducing the storage space for water supply, hydropower, and/or recreation could provide additional flood protection. The potential to reserve more

flood storage space at Oroville Reservoir on the Feather River (750,000 acre-feet) and Bullards Bar Reservoir on the Yuba River (170,000 acre-feet) was evaluated. Reregulating those reservoirs would still leave many tributaries unregulated, would have an adverse effect on water supply yield and hydroelectric power generation, and may not achieve the desired level of flood protection (1 in 200 annual event). This alternative was eliminated because the cost of replacing the lost water supply and hydroelectric power was high and because the alternative would not meet the project flood control goals.

2.3.4 Reregulate Englebright Dam

Changing the operations of an existing reservoir by allocating more storage for flood control by reducing the storage space for water supply, hydropower, and/or recreation could provide additional flood protection. The potential to reserve more flood storage space at Englebright Reservoir was evaluated. Although this alternative had been recommended for further study in the reconnaissance phase, reregulating this reservoir was eliminated as an alternative prior to initiation of the feasibility study. It was determined that reregulating Englebright Reservoir would adversely affect recreation, water supply yield, and hydropower generation and would not provide adequate levels of flood protection in the study area.

2.3.5 Raise Englebright Dam and Reregulate Englebright and Bullards Bar Reservoirs

Raising the height of existing dams could allow additional storage space that could be used for flood control purposes. An alternative that would raise Englebright Dam from its height of 527 feet by various heights and reregulate Englebright Reservoir for flood storage in conjunction with the reregulation of Bullards Bar Reservoir was analyzed. Using Englebright Reservoir for flood control would enable regulation of flows from the uncontrolled Middle and South Yuba Rivers to be reduced during major flood events. As a result, downstream flows would not be allowed to exceed the 135,000 cubic feet per second capacity of the Yuba River levees.

Based on seismic studies of Englebright Dam, it was concluded that raising the dam would be infeasible due to the cost of construction needed to ensure seismic stability. Therefore, this alternative was eliminated from further study because the construction costs would exceed the flood control benefits.

2.3.6 Single-Purpose Reservoir

Construction of new upstream dams and reservoirs, whether single-purpose for flood control or multipurpose for flood control, hydropower, water supply, and recreation, could provide high levels of flood protection. A single-purpose flood control reservoir was considered at a variety of sites on the Yuba River below Englebright Reservoir. The Parks Bar site provided the best construction opportunity, and it was estimated that about 200,000 acre-feet of storage would be necessary to provide downstream areas with protection from a standard project flood. In order to provide protection from a 1 in 200 annual event, an estimated 100,000 acre-feet of storage would be required. Construction of a dam at this site would be very costly due to the relocation of the State Route 20 bridge and roadway, significant construction problems related to existing dredge tailings, extensive excavation due to seismic problems, and the adverse effects on significant environmental resources. Therefore, this alternative was eliminated because the construction costs would exceed the flood control benefits.

2.3.7 Multipurpose Reservoir

Small and large multipurpose reservoirs were considered on the Yuba and South Yuba Rivers. Sites for small reservoirs included a variety of sites on the main stem of the Yuba River. Large multipurpose reservoirs were examined at two sites on the Yuba River and one site on the South Yuba River. There were various limitations to the sites, ranging from potential seepage problems at the dam site, excessive relocations, technical problems due to dredge tailings and extensive diking requirements, and the adverse effects on environmental resources. These alternatives were eliminated because the construction costs would exceed the flood control benefits.

2.4 ALTERNATIVES CONSIDERED IN DETAIL

The alternatives in this section were considered in detail and retained for further study. Alternative 1 (no action) describes the without-project conditions. Alternative 2 (National Economic Development (NED) plan) maximizes net benefits over costs, and alternative 3 provides a slightly lower level of flood protection in reach 1 of the NED plan.

The formulation of these alternatives was done using a risk-based approach. The risk-based strategy was developed by the Corps to analyze the reliability of a channel and levee system and to develop and analyze flood control alternatives. The risk-based approach groups areas with similar hydrologic, hydraulic, and economic characteristics together and evaluates each area for economic feasibility. The grouped areas are called index areas. Each area has an index point, often at

the weak or low point of a levee or channel. For each index point, there is a frequency-flow, flow-stage, and stage-damage relationship which is assigned to the entire index area. The potential flood control measures are evaluated in terms of the three relationships for each index area. Because each index area has different hydrologic, hydraulic, and economic characteristics, different flood control measures and different levels of protection may be applied to different index areas. A complete description of risk-based analysis can be found in Chapter 4 of the Feasibility Report.

There are three index areas which correspond to the study reaches. Index area 1 includes reach 1 - Yuba River/Feather River; index area 2 includes reach 2 - Feather River; and index area 3 includes reach 3 - Marysville ring levee. Alternative measures in these reaches include modifying existing levees by raising, constructing landside berms and drains, modifying berms and drains, constructing berms, installing slurry walls, modifying slurry walls, and installing waterside slurry walls and waterside slurry walls with berms.

Levee raising in most cases involves increasing the "footprint" (width) and height of the levee to provide adequate levee clearance above the water and reduce the risk of overtopping. Levees are usually raised by adding earthfill to the crown and sides of the levee.

Landside berms include constructing vertical and horizontal drains by placing a drainage blanket of crushed rock enclosed in a geotechnical or filter fabric on the levee slope and along the landside levee toe. These drains allow seepage to pass through the levee without allowing the levee material to escape. The berm is then constructed by placing earthfill on top of the drains and against the levee slope. Landside berms and drains would be modified by deepening the vertical drain, extending the horizontal drain, and extending the berm. Existing berms would be raised by adding earthfill on top of the existing berms to increase their height.

Slurry walls are generally used when there is no room to make adjustments to the levee toe to stabilize the levee. The slurry wall is usually constructed by excavating a trench down the center of the levee, sufficiently deep to cut off any seepage paths under the levee. The slurry wall is usually deep enough to "anchor" the wall into a relatively impermeable clay material or to lengthen the seepage path sufficiently to render it harmless. A combination of soil, cement, and bentonite (a clay material) is mixed with water to form a slurry inside the trench. When this material hardens, the slurry wall cuts off seepage through the levee. The slurry walls would be modified by increasing the depth of the trench. Slurry walls would also be placed on the waterside of the levee either beyond the existing levee toe or underneath the existing levee slope in areas of restricted right-of-way. A berm

would be placed over the new slurry wall in the areas where the slurry wall is placed beyond the levee toe.

2.4.1 Alternative 1 (No Action)

The no-action alternative describes the without-project conditions and is the baseline for the environmental analysis described in this EIS/EIR. The without-project conditions for the study area are described in Chapter 2 of the Feasibility Report. Without-project conditions for the affected environment are described in Chapter 3 of the EIS/EIR, and Chapter 4 describes the environmental consequences of the no-action alternative and the other project alternatives. Under the no-action alternative, environmental changes can still occur because the existing environment is not static. The no-action alternative assumes that no Federal action would take place after the work in Phase II of the System Evaluation is completed. The project levees in the study area would provide the design level of flood protection (1 in 65 annual event), and the level of flood protection would not be increased by the Federal Government.

The Phase II work includes levee raising, slurry walls, landside berms, and drains to increase the stability of the levees on portions of the south levee of the Yuba River, east levee of the Feather River, and south levee of Jack Slough. Without the project, the advance work such as modifying slurry walls and drains would not be constructed.

There would continue to be a flood threat to lives and property without the project due to high runoff and combined river and tributary flows which stress existing levees and flood control systems. Urban and agricultural areas are at risk of levee failure, flooding, and damage to residences, business, and crops. Potential flood depths in Linda, Olivehurst, and rural areas range from less than a foot to over 20 feet, depending on the flows and location of the levee break. Flood depths in Marysville would range from 20 to 25 feet. Flooding problems would likely continue in the future due to population increases in Yuba County.

2.4.2 Alternative 2 (NED Plan)

The NED plan is the flood control plan that maximizes net benefits (economic benefits minus project costs) and is the most cost-effective plan. This plan includes the most cost-effective flood control measures for each reach or index area. To achieve maximum cost effectiveness, the level of flood protection may vary for each reach or index area. The NED plan protects reach 1 from a 1 in 250 annual event, reach 2 from a 1 in 200 annual event, and reach 3 from a 1 in 300 annual event. The NED plan, which forms the basis for project cost sharing, is required for all feasibility studies. Alternative 2 (NED plan) is described below.

Construction would begin in the year 2000 and be completed in two seasons, from April to November each year. The three reaches and levee miles are shown on Figures 2-1, 2-2, and 2-3. The work for this alternative is described by reach and levee mile in Table 2-1.

Reach 1 - Yuba River/Feather River

On the south levee of the Yuba River and the east levee of the Feather River, flood control measures would include increasing the slurry wall depths of the Phase II work, levee raising, constructing berms and drains, raising berms, levee reshaping, modifying berms and drains of the Phase II work, and installing slurry walls. The NED plan would provide this reach with protection from a 1 in 250 annual event.

Since the nature of slurry wall construction precludes future deepening of the wall, the slurry wall deepening was completed during construction of Phase II of the System Evaluation. In reach 1, the slurry wall installation would be done from the top of the levee. A 15-acre staging area near Dantoni Road would be used to mix the cement and other materials which would be pumped into the excavated trench. No additional lands would be needed for construction.

Raising levees and berms would be done from the landside in this reach. When the levee is raised less than 0.5 foot, the work could be done within the existing levee embankment limits, and no additional lands would be needed for construction. If the levee is raised more than 0.5 foot, a 10-foot permanent easement and a 30-foot temporary easement from the current levee toe would be needed. In reach 1, levees would be raised between 0.2 foot and 3 feet. Raising the berm would also require a 10-foot permanent and a 30-foot temporary easement from the current levee. Berms would be raised 3 feet in this reach.

Additionally, from LM 4.26 to 6.13, the waterside and landside levee slopes would be reshaped to provide a consistent slope. Levee material would be added or removed as necessary to provide the necessary slope stability to the levees. This would be done within the temporary construction easement.

Berms with drains would be constructed from the landside of the levee and would need a 10-foot permanent easement and a 30-foot construction easement from the new levee toe. The new berm heights and widths in this reach would range from 5 feet high and 10 feet wide to 11 feet high and 18 feet wide, while vertical drain depths would average 12 feet. Horizontal drains are about 4 feet deep and extend the width of the berm.

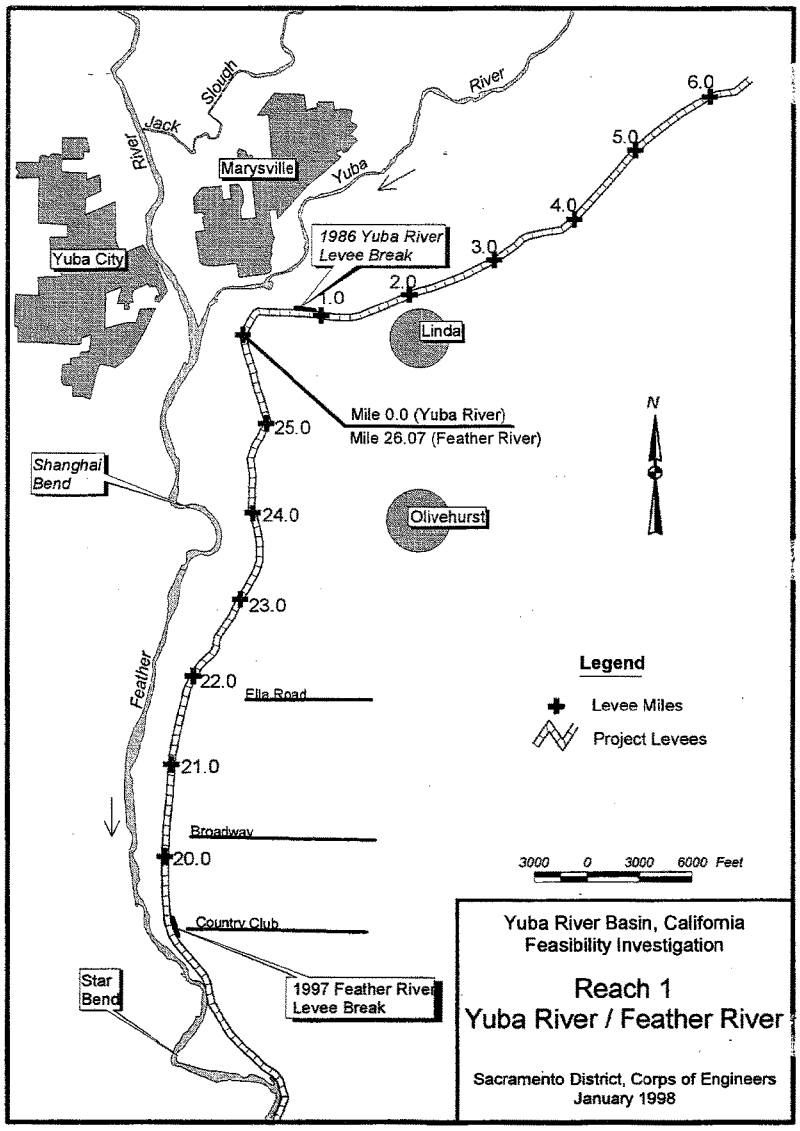

Slough
Jack
River
Marysville
Yuba
River
Yuba City
1986 Yuba River
Levee Break
1.0
2.0
3.0
4.0
5.0
6.0
Linda
Mile 0.0 (Yuba River)
Mile 26.07 (Feather River)
25.0
Shanghai
Bend
24.0
Olivehurst
23.0
Feather
22.0
Ella Road
21.0
Broadway
20.0
Country Club
Star
Bend
1997 Feather River
Levee Break
N
Legend
Levee Miles
Project Levees
3000 0 3000 6000 Feet
Yuba River Basin, California
Feasibility Investigation
Reach 1
Yuba River / Feather River
Sacramento District, Corps of Engineers
January 1998

Figure 2-1

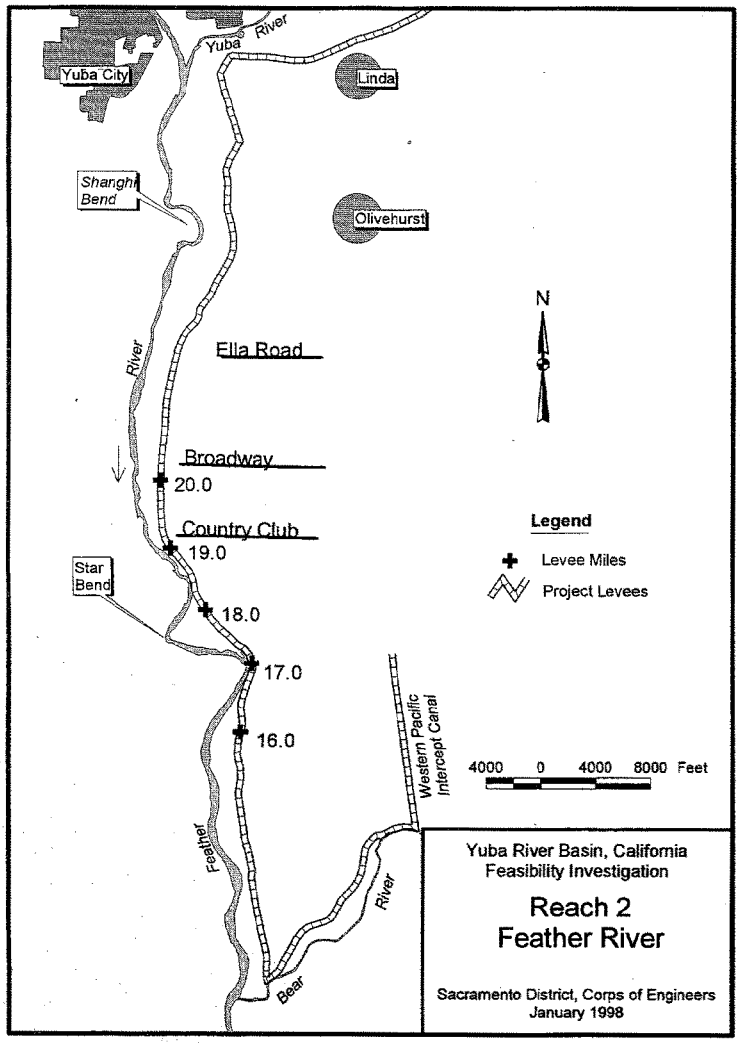

Yuba River
Yuba City
Linda
Shanghai Bend
Olivehurst
N
River
Ella Road
Broadway
20.0
Country Club
19.0
Legend
Levee Miles
Project Levees
Star Bend
18.0
17.0
16.0
Western Pacific Intercept Canal
4000 0 4000 8000 Feet
Feather
River
Bear
Yuba River Basin, California
Feasibility Investigation
Reach 2
Feather River
Sacramento District, Corps of Engineers
January 1998

Figure 2-2

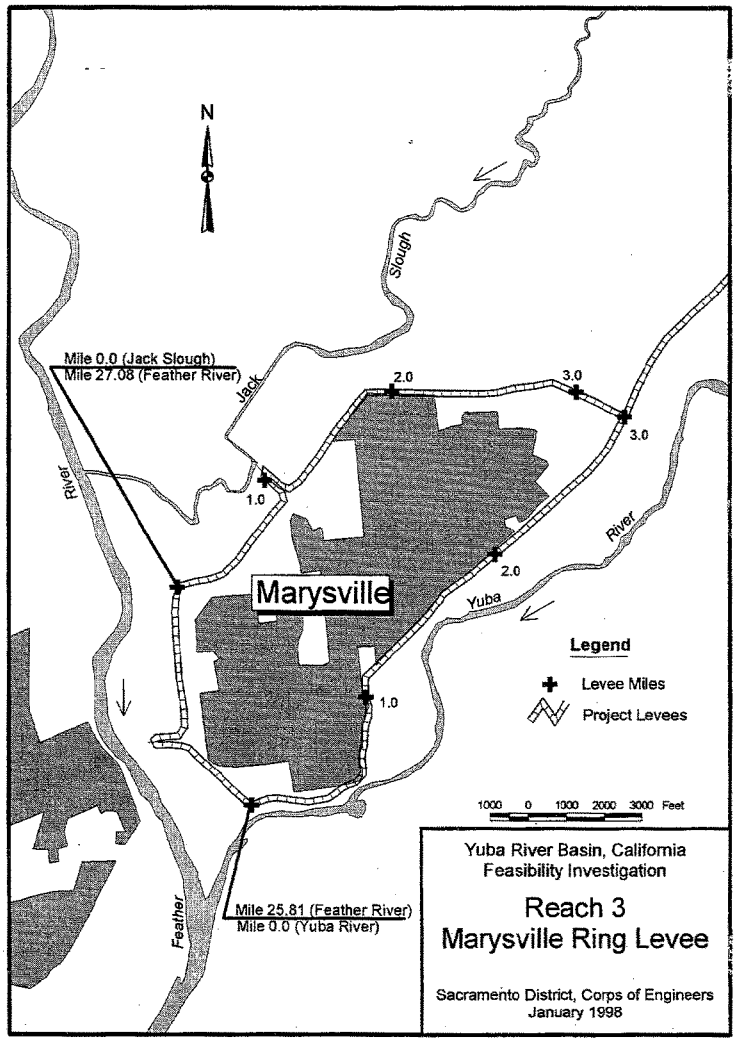

N
Slough
Jack
Mile 0.0 (Jack Slough)
Mile 27.08 (Feather River)
River
2.0
3.0
3.0
1.0
Marysville
2.0
Yuba
River
1.0
Legend
Levee Miles
Project Levees
1000 0 1000 2000 3000 Feet
Feather
Mile 25.81 (Feather River)
Mile 0.0 (Yuba River)
Yuba River Basin, California
Feasibility Investigation
Reach 3
Marysville Ring Levee
Sacramento District, Corps of Engineers
January 1998

Figure 2-3

Table 2-1. Description of Project Alternatives

Study Area Location (Levee mile)	Alternatives		
	Alternative 1 (No Action)	Alternative 2 (NED)	Alternative 3
Reach 1-Yuba River			
0.00-0.28[2]	No work	Increase slurry wall depth and levee raise (1.5')	Increase slurry wall depth and levee raise (0.5')
0.28-0.35	No work	No work	No work
0.35-0.92	No work	Levee raise with berm (10' x 13') and drain, raise levee 0.5'	Berm (9' x 16') and drain
0.92-1.23	No work	Slurry wall and levee raise 0.7'	Slurry wall
1.23-1.79[2]	No work	Increase slurry wall depth	Increase slurry wall depth
1.77-2.18[1]	No work	Modify berm (10' x 20') and drain, raise levee 0.2'	Modify berm (9' x 18') and drain
2.18-2.22	No work	No work	No work
2.22-2.97[2]	No work	Increase slurry wall depth	Increase slurry wall depth
2.92-3.56[1]	No work	Modify berm (9' x 16') and drain	Modify berm (8' x 16') and drain
3.56-3.59	No work	Raise levee 0.7', berm (9' x 20') and drain	Berm (8' x 16') and drain
3.59-3.86[1]	No work	Modify berm (9' x 16') and drain	Modify berm (8' x 16') and drain
3.86-4.00	No work	No work	No work
4.00-4.26[1]	No work	Modify berm (6' x 12') and drain	No work
4.26-5.5	No work	Slurry wall, reshape the levee	Slurry wall, reshape the levee
5.5-5.99	No work	Slurry wall, reshape the levee, levee raise 1.8'	
5.5-5.86	No work		Slurry wall, reshape the levee, levee raise 0.8'
5.99-6.13	No work	Slurry wall, reshape the levee	
5.86-6.13	No work		Slurry wall, reshape the levee
Reach 1-Feather River			
20.00-20.49	No work	Raise berm 3'	Raise berm 2'
20.49-21.42[1]	No work	Modify berm (10' x 16') and drain	Modify berm (9' x 14') and drain
21.42-22.25[1]	No work	Modify berm (11' x 16') and drain	Modify berm (10' x 14') and drain
22.25-23.64[1]	No work	Modify berm (11' x 18') and drain	Modify berm (10 x 16') and drain
23.64-25.12	No work	Slurry wall and raise levee 1.0'	Slurry wall
25.12-26.07[2]	No work	Increase slurry wall depth, raise levee 0.5'	Increase slurry wall depth, raise levee 0.5'
Reach 2-Feather River			
15.98-16.61[1]	No work	Modify berm (10' x 16') and drain	Modify berm (9' x 14') and drain

Table 2-1. Description of Project Alternatives - Continued

	Alternatives		
16.59-17.12[2]	No work	Increase slurry wall depth	Increase slurry wall depth
Reach 3-Yuba River			
0.00-1.00	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (30' deep) and berm
Reach 3-Feather River/Jack Slough			
0.00-0.25	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (30' deep) and berm
0.25-0.68	No work	No work	No work
0.68-3.25	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (30' deep) and berm
Reach 3-Marysville Ring Levee			
25.81-26.21	No work	Waterside slurry wall (28' deep) and berm	Waterside slurry wall (28' deep) and berm
26.21-27.08	No work	Waterside slurry wall (38' deep) and berm	Waterside slurry wall (38' deep) and berm

[1] Toe drain deepened as Section 104 credit work under Phase II of the Systems Evaluation, (contract 2B).
[2] Slurry wall deepened as Section 104 credit work under Phase II of the Systems Evaluation, (contract 2A).

Modifying the berms and drains of the Phase II work would include increasing the berm heights and vertical drain depths and extending the horizontal drains. The vertical drain construction is done underneath the levee berm, which precludes future deepening of the drain without removing the berm. Therefore, the vertical drain modifications were completed during construction of the Phase II work. The horizontal drains and berms would be extended during the construction of this project. These modifications would include extending the horizontal drain and berm from the landside of the levee by adding material to the existing levee slope. The berm heights would vary from 6 to 11 feet, and widths would vary from 9 to 18 feet while vertical drains are generally deepened 1 to 2 feet. A 10-foot permanent easement and a 30-foot construction easement would extend from the new toe of the berm. A borrow/disposal site would be needed for the berm and drain construction. The tentative location is on Ella Road in Yuba County. New slurry wall construction would be done from the top of the levee as described for the slurry wall deepening.

Reach 2 - Feather River

Originally, Phase II work scheduled for reach 2 extended from LM 20.00 to LM 15.98 on the east levee of the Feather River. Prior to construction of Phase II, however, the work planned for LM 20.00 to LM 17.12 was changed from berm and drain work with levee raising to a slurry wall. The construction change was done after a levee break in this area during the 1997 flood event showed that a slurry wall would be a more effective solution to the levee seepage problems. Technical analysis indicated that the berm and toe drain work alone would only be partially effective. With the slurry wall, the seepage energy would be reduced to a level which would not threaten the structural integrity of the levee system. Since engineering and economic studies were already underway for this feasibility study, the change was not incorporated but will be added before the Feasibility Report is finalized. The environmental studies did incorporate the change; therefore, the area between LM 20.00 and LM 17.12 was excluded from the environmental analysis.

Work for reach 2 includes modifying berms and drains and increasing slurry wall depths of the Phase II work. Construction would take place as described in reach 1. A 9-acre staging area would be used between Broadway and Anderson Road. The borrow/disposal site would be as described in reach 1. The NED plan would provide this reach with protection from a 1 in 200 annual event.

Reach 3 - Marysville Ring Levee

The ring levee protects Marysville from flooding from the Yuba River, Feather River, and Jack Slough. Work would take place on the north levee of the Yuba River, south levee of Jack Slough, and east levee of the Feather River. Flood control improvements include waterside slurry wall and berm construction. At one location, LM 0.25 to LM 0.68 along Jack Slough, construction including increasing the slurry wall depths has been completed under an early construction contract for Phase II. Construction for reach 3 would take place from the waterside of the levee because of the close proximity of structures on the landside or Marysville side of the levee.

There are two types of slurry wall designs in this reach. The first design includes excavation for the slurry wall beyond the existing toe of the levee. The slurry wall would be installed and backfilled with an impervious material, earthfill, and filter fabric which would form the new berm. The easements needed for this design would be a 10-foot permanent and 30-foot construction easement beyond the toe of the new berm. The new berms would be about 12 feet wide. The second design would be used where there are right-of-way or environmental restrictions on the waterside of the levee. This design would excavate a portion of the existing levee slope and install the slurry wall underneath the levee slope. There would be no berm with this design. Both of the slurry wall designs would correct foundation seepage problems, and the costs would be similar. The easements needed for this design would be a 30-foot construction easement from the existing levee toe. Two staging areas have been identified. The first staging area would be about 4 acres located along Jack Slough Road, and the other staging area would be about 3 acres near the Marysville Public Works Center. The NED plan would provide this reach with protection from a 1 in 300 annual event.

2.4.3 Alternative 3

Alternative 3 was formulated to slightly reduce the level of flood protection in reach 1 of the NED plan. The work for this alternative is described by reach and levee mile in Table 2-1. Generally, the work for Alternative 3 would consist of the same measures as Alternative 2, but the heights, widths, and/or depths would be adjusted for the difference in level of protection in reach 1. The construction schedule, methods, easements, borrow/disposal site, and staging areas would be the same as Alternative 2.

2.5 COMPARATIVE EFFECTS AND MITIGATION OF THE ALTERNATIVES

For analytical purposes, the environmental effects of the various alternatives have been classified as direct and indirect effects. Direct effects would result

immediately from constructing and operating the project. Indirect effects would result from the effects of the project on regional growth patterns in the study area. These effects were evaluated by comparing environmental conditions with the project to the likely conditions without the project. For this comparison, a 100-year period of analysis was used. Table 2-2 summarizes the direct environmental effects of the no-action alternative, NED plan, and the third alternative. Chapter 4 describes these effects in detail.

Mitigation for all direct effects of the NED plan and the third alternative would be a joint responsibility of the Corps and the non-Federal sponsor on a cost-shared basis. The mitigation measures to avoid, minimize, or compensate for these effects are summarized in Table 2-3 and are discussed in detail in Chapter 4 and Section 5.7. Alternative 1 is not included in this table because the no-action plan would not include any Federal action so no project mitigation would be needed.

2.6 ENVIRONMENTAL COMMITMENTS

Environmental commitments are defined as the required measures, particularly mitigation measures, incorporated into projects as approved by the Corps. Commitments are related to the mitigation measures and environmental monitoring program described in this EIS/EIR.

Commitments related to direct environmental effects would be implemented during (1) preconstruction engineering and design (PED) and land acquisition, (2) project construction, or (3) operation and maintenance (O&M). Each of these three categories is defined in the following paragraphs, and the agency responsibilities are listed.

1. **Preconstruction Engineering and Design, and Land Acquisition.** The PED process begins prior to project authorization and extends until all project-related plans and specifications are completed. This process includes preparation of detailed mitigation plans and ongoing coordination with other agencies. Land acquisition can be undertaken following project authorization at the Federal and State levels and execution of the Project Cooperation Agreement. Acquisition of lands required for mitigation should occur concurrently with all other project land acquisition. The acquisition of all lands, easements, rights-of-way, and relocations included in any project mitigation measure is the responsibility of the non-Federal sponsor.

2. **Project Construction.** The Corps is responsible for administering project construction contracts and for ensuring that the mitigation measures included in these contracts are carried out. The costs of contract administration are shared with the non-Federal sponsor in the same way as the overall project costs.

Table 2-2. Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3
Land Use	Future growth and land use changes would occur as described in City and County General Plans.	No change from current plans.	No change from current plans.
Transportation	Traffic volumes are expected to increase as projected in the City and County General Plans.	Temporary increases in trips, volumes, roadway safety hazards, parking, and traffic disruption during construction.	Temporary increases in trips, volumes, roadway safety hazards, parking, and traffic disruption during construction.
Noise	Noise levels would be the same as existing conditions.	Temporary increase in noise levels during construction.	Temporary increase in noise levels during construction.
Air Quality	Local emission rates would likely change with projected traffic volume increases.	Temporary increase in combustion, dust, and asphalt paving emissions during construction.	Temporary increase in combustion, dust, and asphalt paving emissions during construction.
Vegetation and Wildlife	Vegetation and wildlife resources are not expected change.	Temporary and permanent loss of grassland and agricultural land during construction. Permanent loss of 2.23 acres of woodland habitat.	Temporary and permanent loss of grassland and agricultural land during construction. Permanent loss of 2.23 acres of woodland habitat.
Special Status Species	Habitat for special status species is not expected to change.	Potential loss or disturbance of the following species or their habitat: giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle.	Potential loss or disturbance of the following species or their habitat: giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle.
Cultural Resources	No change in the project area.	No known adverse effects. Surveys would be done prior to construction.	No known adverse effects. Surveys would be done prior to construction.

Table 2-3. Summary of Mitigation

Affected Environment	Alternative 2 (NED Plan)	Alternative 3
Land Use	No project effects to land use; therefore, no mitigation needed.	No project effects to land use; therefore, no mitigation needed.
Transportation	Temporary effects would be offset by best management practices.	Temporary effects would be offset by best management practices.
Noise	Temporary effects of construction noise would be reduced by best management practices.	Temporary effects of construction noise would be reduced by best management practices.
Air Quality	Air quality effects would be reduced by best management practices.	Air quality effects would be reduced by best management practices.
Vegetation and Wildlife	Mitigation would use available "credits" for 2.98 acres at the existing mitigation site for Phase II of the System Evaluation.	Mitigation would use available "credits" for 2.98 acres at the existing mitigation site for Phase II of the System Evaluation.
Special Status Species	Specific mitigation/avoidance measures are proposed for the giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle. Mitigation will be finalized during consultation the U.S. Fish and Wildlife Service.	Specific mitigation/avoidance measures are proposed for the giant garter snake, Swainson's hawk, and valley elderberry longhorn beetle. Mitigation will be finalized during consultation with the U.S. Fish and Wildlife Service.
Cultural Resources	No known effects until surveys are completed; no mitigation at this time.	No known effects until surveys are completed; no mitigation at this time.

3. Operation and Maintenance. State law requires that the Reclamation Board pass on O&M responsibilities and their costs to the local beneficiaries of the project. As a result, Reclamation District 784 and the Marysville Levee Commission would be responsible for maintaining the completed project. The Corps would prepare the O&M manual which the District and the Commission are responsible for implementing. The O&M manual includes requirements for annual inspections by qualified specialists to review and evaluate all mitigation features and ensure compliance. The District and Commission would be responsible for conducting semiannual inspections and reporting on all project features. The Corps has continuing oversight responsibilities to review these semiannual reports, ensure mitigation compliance, and issue orders for corrective actions if necessary.

The environmental commitments to mitigate the direct effects of the project alternatives are listed below.

Transportation

- During project construction, mitigation measures as listed in Section 4.3.4 will be implemented to reduce project effects to less than significant. The mitigation includes measures for parking, roadway safety, and bicycle lane use.

Noise

- During project construction, mitigation measures as listed in Section 4.4.4 will be implemented to minimize disruption to sensitive receptors.
- Noise-reduction devices on construction equipment will be used to reduce noise by an average of 5 to 10 A-weighted decibels at 50 feet.

Air Quality

- Mitigation measures as listed in Section 4.5.4 will be implemented during construction to reduce the quantity of project-induced emissions.

Vegetation and Wildlife

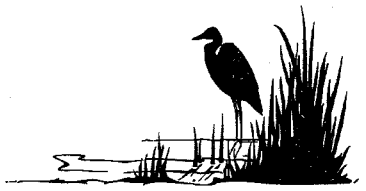
- Available "credits" for 2.98 acres will be used at the mitigation site for Phase II of the System Evaluation as described in Section 4.6.4.

Special Status Species

- Mitigation for affected species and habitat will be done in accordance with the biological opinions of the U.S. Fish and Wildlife Service and Department of Fish and Game. Potential mitigation measures are described in Section 4.7.4.

CHAPTER 3.0

AFFECTED ENVIRONMENT



CHAPTER 3.0

AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the existing or baseline conditions in the study area. The baseline conditions can also be called the pre-project conditions. The baseline or pre-project conditions provide a framework to compare with-project conditions and to determine project-induced effects described in Chapter 4. Resources not affected by the project are described first (environmental setting), followed by the resources that may be affected by the alternatives (affected environment). The environmental setting includes climate; topography, geology, and soils; agriculture, prime and unique farmlands; water quality; fisheries; socioeconomics; recreation and esthetics; and hazardous, toxic, and radiological waste. The affected environment includes land use, transportation, noise, air quality, vegetation and wildlife, special status species, and cultural resources. The effects on these resources are described in the same order in Chapter 4. A large part of the information for this chapter was summarized from the Yuba County General Plan, Volume 1, Environmental Setting and Background, May 1994.

3.2 ENVIRONMENTAL SETTING

This section describes resources in the study area that would not be significantly affected by the project. These resources are presented here to add to the overall understanding the study area.

3.2.1 Climate

In general, the climates of California are a result of topography and the position of the semi-permanent subtropical cell, a center of high atmospheric pressure in the Pacific Ocean off the California coast. During the summer, the cell moves over northern California and Nevada and effectively blocks the movement of Pacific storm systems into California, causing the annual summer drought. During the winter, the cell retreats to the southwest, allowing storms and frontal systems

to move into northern and central California. The Coast Ranges and the higher Sierra Nevada act as barriers to these storms during the wet seasons. As a result of these weather patterns, California winters are cool and wet, while summers are typically hot and dry.

In the valley portions of Yuba County, about 85 percent of the annual rainfall occurs between October and March; about 95 percent falls between October and April. At Marysville, average annual rainfall is 20.59 inches. Mean annual temperature in Marysville is 62 degrees Fahrenheit (° F). January is generally the coldest month with a mean low temperature of 35° F and an average high temperature of 54° F. July is the hottest month with an average high temperature of 96° F and an average low of 61° F. High temperatures commonly exceed 100° F.

During the winter, wind patterns in the Sacramento Valley are either northerly or southerly depending on the direction of storm systems. Atmospheric inversions often occur in the winter, during which temperature increases with elevation. Heavy fog (known in central California as "tule fog") forms during this season, particularly in December and January. The air beneath the fog remains cool, while the air above the fog is warm, contributing to the inversion layering.

3.2.2 Topography, Geology, and Soils

The study area is located within Yuba County on the east side of the Sacramento Valley in northern California. The Sacramento Valley is bounded by the Coast and Diablo Ranges on the west and the Sierra Nevada on the east. Three physiographic areas are identified within Yuba County: the valley area, foothill area, and mountain area. The study area falls within the relatively flat valley area, which consists primarily of agricultural and urban land uses and is a flat flood plain for the Feather and Yuba Rivers. The elevation ranges from 30 feet above mean sea level (m.s.l.) on the valley floor to about 250 feet m.s.l. in the eastern foothill area.

Enclosed between the Sierra Nevada on the east and the Coast Ranges on the west, the Central Valley is a long narrow trough once filled with seawater and now with sediments accumulated over millions of years. The surface of the Central Valley is composed of unconsolidated Pleistocene (2 to 3 million years ago) and Recent (10,000 years ago) sediments. The valley floor is composed of alluvial fan and channel deposits from the various rivers in the area. Adjacent to the Feather River are the most recent sedimentary rocks that overlie igneous rocks while older sedimentary rocks are located farther east. The sedimentary rocks are of both marine and continental origin and are frequently interbedded with tuff-breccias.

The principal ground-water aquifers in the valley area are composed of continental sediments of Pleistocene and Recent age. These sediments consist of as much as 100 feet of Pleistocene sands and gravels overlain by up to 125 feet of Recent alluvial fan, flood plain, and stream channel deposits. Important aquifers are found near Marysville, Wheatland, and Beale Air Force Base in southeast Yuba County.

California is located in the circum-Pacific earthquake zone and is the most seismically active area in the United States. The western and eastern portions of the State have the highest occurrence of seismic activity. Yuba County lies in east-central California, an area experiencing relatively low seismic activity. A fault is defined as a fracture zone in the earth's crust along which there has been displacement of the sides relative to one another. The two types of faults are active and inactive. Active faults have experienced displacement in historic time, with future fault movement expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant. The nearest active fault near Yuba County is the Cleveland Hill fault, which is located about 20 miles northeast of Marysville. This fault was the source of the 5.7-magnitude earthquake in the Oroville area in 1975.

After the Oroville earthquake, Federal and State studies determined that the Foothills fault system within Yuba County is a continuation of the Cleveland Hill fault. Portions of the Foothills fault system are considered to be capable of seismic activity, but the activity is estimated to have a very long recurrence interval. As a result, the California Division of Mines and Geology determined that special seismic zoning for the Foothills fault system was not necessary.

Soils in the study area can be divided into two broad groups: (1) those derived from recent alluvial deposits, and (2) those derived from old alluvial fan or terraces. The majority of soils found on the valley floor are shallow to moderately deep, sloping, well drained soils with very slowly permeable subsoils underlain with hardpan such as San Joaquin and Redding-Corning-Pardee soils. They have good natural drainage, slow subsoil permeability, and slow runoff. Since their inherent fertility is low, these soils are primarily used for pasture, range, grains, and rice.

Soils found immediately adjacent to the Yuba and Feather Rivers are dominated by deep, nearly level, well drained loamy Columbia-Holillipah-Shanghai soils. The natural drainage is good, and the soils have slow to moderate subsoil permeability. Runoff is slow, and their inherent fertility is high. These soils are used for pasture, orchards, and row crops. The river terraces consist of Conejo-Kilaga soils, which are very deep, well-drained alluvial soils. These soils are used for irrigated orchards and cultivated crops such as walnuts, peaches, prunes, almonds, kiwis, tomatoes, dry beans, and melons. In the areas adjacent to the

Yuba River where dredge tailings are located, soil characteristics are variable. Mine tailings, which are very deep materials deposited during gold mining operations, are the main soil type.

3.2.3 Agriculture, Prime and Unique Farmlands

Agriculture is the most extensive land use in Yuba County and the most significant component of the county's economy. About 68 percent of the total county area is currently in agricultural croplands and pasture.

Many agricultural counties have implemented the Williamson Act (California Land Conservation Act), which reduces property taxes on qualifying agricultural land in exchange for a commitment from the landowner not to develop the land with uses other than those compatible with and supportive of agriculture. Yuba County has chosen not to participate in this program. In response to the need to protect agricultural land and operations, however, the Yuba County Board of Supervisors has adopted a consumer disclosure ordinance that declares it to be in the public interest to preserve and protect agricultural land and operations for agricultural use. The ordinance protects lands zoned as agriculture by notifying prospective purchasers adjacent to agricultural land of the inherent nature of agricultural operations such as noise, dust, odor, fertilizers, pesticides, smoke, and vibrations.

The designation of prime farmland grew out of a program by the Natural Resource Conservation Service (NRCS) (formally the Soil Conservation Service) to map the Nation's important farmlands. In 1980, the California Department of Conservation initiated the Farmland Mapping Program to supplement the NRCS program. The continuing conversion of agricultural lands led to the passage of the Farmland Protection Act (Public Law 97-98) in 1981, which was amended in 1994. The act expressed the need for all Federal agencies to recognize the effect of their actions and programs on the Nation's farmlands.

Under the Farmland Protection Act, the U.S. Department of Agriculture was charged with implementing a program to develop criteria for identifying the effects of Federal programs on the conversion of farmlands to nonagricultural uses. These criteria were published in 1983. The major requirements are that (1) Federal agencies must use the U.S. Department of Agriculture's criteria to identify and take into account the adverse effects of their programs on the preservation of farmland and (2) Federal agencies must consider alternative actions, as appropriate, to reduce such adverse effects and ensure that their programs, to the extent practicable, are compatible with State, local, and private programs. The act also authorizes local governments to identify farmland of local importance and exempts land already committed to urban development.

The NRCS developed the following definitions of important farmlands, as modified for California:

> "Prime Farmland" is land with the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture regime needed to produce sustained high yields of crops when treated and managed, including water management, according to current farming methods. Prime farmland must have been used for the production of irrigated crops within the last 3 years. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.
>
> "Farmland of Statewide Importance" is land other than prime farmland with a good combination of physical and chemical characteristics for the production of crops. Like prime farmland, it must have been used for the production of irrigated crops within the last 3 years. It also does not include publicly owned lands for which there is an adopted policy preventing agricultural use.
>
> "Unique Farmland" is land that does not meet the criteria for the preceding categories, but is currently used for the production of specific high economic value crops. This land has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality and high yields of a specific crop when treated and managed according to current farming methods. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

In Yuba County, the croplands are usually found in areas of Prime Farmland. These lands are generally along the historic flood plain of the Yuba and Feather Rivers due to the relatively flat topography, water supply, and soil conditions. In the county, there are 46,491 acres of Prime Farmland, 11,001 acres of Farmland of Statewide Importance, and 37,844 acres of Unique Farmland.

Construction associated with levee raising and berm/drain work in reaches 1 and 2 would affect 11.24 acres of Prime Farmland and 3.32 acres of Unique Farmland with Alternative 2 and 11.59 acres of Prime Farmland and 1.27 acres of Unique Farmland with Alternative 3. With levee raising work greater than 0.5 foot, the levee footprint is increased, causing the permanent loss of any farmland within the construction easement for the length of the levee raise. Constructing a new berm or extending an existing berm would cause the permanent loss of farmland for the length of the work. Use of important farmland within the construction easement would be temporarily disrupted during construction activities but would return to agriculture after the project is completed. The 15-acre staging area along

the Yuba River would be temporarily disturbed by construction traffic but would return to agriculture after the project is completed. As a result, there would be no permanent loss of important farmland within the construction easement or this staging area. The 9-acre staging area along the Feather River is not important farmland so there would be no adverse effects. The 60-acre borrow/disposal site in reach 2 is currently designated as a stormwater detention basin by local land use plans. Therefore, it is assumed that coordination for potential effects to important farmland was completed during development of the local plans.

Project construction on the ring levee around Marysville would affect important farmland in reach 3. Waterside slurry wall and berm work would affect 1.2 acres of Prime Farmland and 4.4 acres of Statewide Important Farmland for both Alternatives 2 and 3. If the slurry wall is installed at the levee toe, there would be temporary disturbance within the construction easement during construction and permanent loss of farmland due to the berm footprint. The staging areas (3 and 4 acres) are not important farmland; therefore, there would be no adverse effects.

Coordination was initiated with NRCS for potential effects to prime, unique, or statewide important farmlands due to the project. A Farmland Conversion Impact Rating has been completed and sent to the NRCS for evaluation. The NRCS did not have any comments and coordination is completed.

3.2.4 Water Quality

The Yuba and Feather Rivers are part of the Sacramento River watershed along with numerous other streams and rivers that drain the western slopes of the Sierra Nevada and Cascades, emptying into the Sacramento River. In general, surface waters in the study area are of good to excellent quality, except for local degradation as streams pass through urban or agricultural areas (Corps, 1992). Agriculture is the largest water user in the study area, and surface water is generally used for agricultural purposes.

In the Yuba and Feather Rivers, variations in overall water quality are usually correlated with fluctuations in flow rates throughout the year. During heavy storm runoff in the winter and spring, the turbidity and debris levels in the rivers are high. In the spring and early summer, the water quality is affected by agricultural drainage and natural runoff. During periods of low flows, specifically the late summer-early fall, water quality decreases due to higher water temperatures and concentrations of pollutants.

Surface water quality in the study area depends primarily on the amount of flow and the amount of pollutants discharged into the water from urban and

agricultural areas. Creation of impervious ground surfaces through construction of pavements and buildings leads to excessive surface runoff during storms where natural ground surfaces had previously acted to absorb or slow this runoff. In urban areas, pollutants from motor vehicles, including petroleum hydrocarbons, glycol (from radiator coolants and anti-freezes), and dissolved heavy metals such as lead and zinc from automotive batteries, are often deposited on pavements. Stormwater runoff picks up these pollutants, and without proper controls, carries them into streams and lakes.

Agricultural runoff is also discharged into the streams and rivers. Pollutants such as pesticides, fertilizer residues, and other hazardous substances from agricultural lands contribute to surface water quality problems in the study area. Irrigation ditches are found throughout the study area. They are used to convey agricultural water and generally have poor water quality due to high temperatures and high nutrient loads.

Due to the availability of surface water in the study area, ground-water levels have stayed fairly constant since monitoring began in the 1940's. Ground water for urban uses is provided by a number of water service companies to most of Yuba County including the city of Marysville. The quality of the ground-water supplies is generally good although the possibility exists for contamination from pesticides, fertilizer residues, and hazardous materials such as heavy metals.

In the study area, the surface or ground-water quality is not expected to change significantly from existing conditions with either of the project alternatives.

The levees along the Yuba and Feather Rivers in the project area are set back from the rivers. The distances between the proposed levee work sites and the rivers vary depending on the reach and location of the site. The distances of the work sites from the rivers vary from about one-fourth mile to 2 miles in reach 1 and from about one-sixteenth mile to one-half mile in reach 2. The distances of the work sites from the rivers and Jack Slough vary from about one-sixteenth mile to one-half mile. As a result, any debris, soil, or fuel spills would not adversely affect water quality in the rivers. In addition, the slurry wall work would take place from the top of the levee, eliminating any potential for adverse water quality effects. Construction safeguards such as drip pans for construction equipment would be used to prevent spills that may affect ground-water quality. Additionally, any fuels or lubricants for construction equipment would be stored within double-containment per Federal requirements.

In reaches 1 and 2, levee raising over 0.5 foot would increase the footprint of the levee on the landside. However, no construction activities would adversely affect water quality. Berm work and berm/drain work would also be done from the

landside of the levee, avoiding any adverse effects to water quality. The staging areas in reaches 1 and 2 are on the landside of the levee so construction staging activities would have no adverse effects to water quality. The borrow/disposal site is not near water and therefore would have no adverse effects to water quality.

At the ring levee around Marysville between LM's 2.0 and 3.0 on Jack Slough, waterside slurry wall work would be modified to avoid the irrigation drainage ditches. The slurry wall would be installed underneath the existing levee slope to avoid affecting the ditches. The construction easement would extend 30 feet from the levee toe. The existing ditches are about 50 feet from the levee toe. All of the excavated material would be contained within the construction easement. The remainder of the work in reach 3 would also be on the waterside of the levees. However, the levee is also set back far enough from Jack Slough to avoid any construction-related effects such as fuel spills or debris. The staging areas in this reach are also far from the channels so no adverse effects to water quality are anticipated.

3.2.5 Fisheries

The river systems, lakes, and reservoirs in Yuba County support a variety of cold and warm water fish species. In the study area, both the Feather and Yuba Rivers are tributaries to the Sacramento River, a migratory path for anadromous fish. There are at least 28 species of anadromous and resident fish in the Yuba River (FWS, 1993). Anadromous species include chinook salmon (*Oncorhynchus tshawytscha)*, steelhead trout *(Oncorhynshus mykiss)*, American shad (*Alosa sapidissima)*, striped bass (*Morone saxatilis)*, green and white sturgeon (*Acipenser medirostris* and *Acipenser transmontanus*), and Pacific lamprey (*Entosphenus tridentatus)*. The Yuba River is very unique among California's large anadromous fish streams because it is managed as a chinook salmon and steelhead trout stream. Hatchery facilities and supplementation of reared stock are not needed, as with many of California's valley rivers. The Feather River is home to many of the same species found in the Yuba River.

Most California chinook salmon are fall spawners and initiate their spawning migration into the Yuba River in late September, with the majority occurring in October and November with an occasional run as late as December and January. Spawning migration for the remaining runs can last until June. On the Feather River, adult spring-run chinook salmon first appear in the spring and generally reside in the upper river just below the fish diversion dam downstream of Oroville Dam until spawning begins in September. Many of these fish enter the Feather River Hatchery below Oroville Dam and are artificially spawned and propagated (FWS, 1993). Natural spawning for the fall-run chinook salmon occurs from about

the mouth of Honcut Creek near Live Oak to the uppermost riffles immediately downstream from the Feather River Hatchery.

Rainbow and the anadromous steelhead trout also inhabit the Yuba River. Both rainbow and steelhead trout are spring spawners (February to June), but steelhead typically migrate upstream several months before they actually spawn. In the lower Yuba River, the spawning migration begins in October and may extend through January. Steelhead trout also use the Feather River for spawning and rearing. Spawning occurs upstream of Marysville on both rivers.

The main American shad runs in California are in the Sacramento River up to Red Bluff and in the lower reaches of the river's major tributaries (American, Feather, and Yuba Rivers), as well as the Mokelumne and Stanislaus Rivers. The Sacramento River above Knights Landing, Feather River above Yuba City, and the entire American and Yuba Rivers are not season-long nursery areas for juvenile shad. The lower Yuba River supports a shad sport fishery, which is generally confined to the area between Daguerre Point Dam and the confluence with the Feather River from May to June. Further migration upstream is prohibited by inadequate pools and jump-type fish ladders, which few shad use.

Striped bass inhabit the lower Yuba River below Daguerre Point Dam although migration does not occur farther upstream due to poorly designed fish ladders which do not take into account the fish's swimming behavior. Unlike salmonids, striped bass are believed to have poorly developed jumping ability. Although these fish enter the river in May and June, spawning and rearing of the young have not been recorded in the river (FWS, 1993).

In California, large sturgeon runs occur in the Sacramento and Feather Rivers, but there may be small runs in the San Joaquin, Klamath, Eel, Mad, and Trinity Rivers.

Resident species such as largemouth and smallmouth bass (*Micropterus salmoides and Micropterus dolomieui)*, Sacramento sucker (*Catostomus occidentalis)*, Sacramento squawfish (*Ptychocheilus grandis)*, white catfish (*Ictalurus catus)*, bluegill (*Lepomis macrochirus)*, and white crappie (*Pomoxis annularis)* are also found in the Yuba and Feather Rivers.

Fishery resources in the Feather and Yuba Rivers are not expected to change from existing conditions with either Alternative 2 or 3. In reaches 1 and 2, the slurry wall work, levee raising, berm work, and the berm/drain work would all take place on the levees and adjacent work areas that are far from the rivers. The levees are set back far enough from the rivers so that no streamside vegetation would be disturbed, and no debris, soil, or fuel spills would adversely affect fish

habitat. The staging area and borrow/disposal site are located on the landside of the levee; therefore, there would be no adverse effects to fish or their habitat.

In reach 3, slurry wall and berm work would take place from the waterside of the levee. However, no aquatic effects are expected from either alternative. The waterside of the levee is located away from the Yuba and Feather Rivers as well as Jack Slough. Activities at the construction easement areas would not disturb streamside vegetation, and no debris, soils, or fuel spills would affect fish habitat. All irrigation drainage ditches in reach 3 would be avoided. The staging areas are adjacent to the levees away from the water; therefore, no adverse fishery effects would occur.

3.2.6 Socioeconomics

This section describes the existing socioeconomic conditions in the study area, including population, employment, housing, and public facilities and services. This discussion is based on State statistics, Federal census data, and City and County General Plans. In addition, the reasons why the project would not affect socioeconomic conditions are explained.

The project is located in Yuba County, which had a population of 64,100 in 1995 (California Department of Finance, 1995). From 1990 to 1995, the growth rate in Yuba County was approximately 2 percent per year. During the early 1990's, many people moved to Yuba County because of the short commute to Sacramento and the lower cost of housing in Yuba County. Over the last few years, however, the cost of housing in the Sacramento area has gone down, and some people are now buying houses in that area. Planners in the Yuba County area believe that future growth in the county may not be as high as originally estimated because of the lower cost of homes closer to Sacramento.

Cities in the study area include Marysville, Linda, and Olivehurst. Although Marysville is not the most highly populated area, it does have the most urban development in the study area. Most of the commercial and industrial development in the county has occurred in Marysville. In 1995 the actual population of Marysville was 12,850, while Linda and Olivehurst had populations of 14,102 and 3,179, respectively (SACOG, 1997). Yuba County is expected to grow by approximately 65 percent by the year 2020; however, most of this growth is expected outside the study area (see Table 3-1). Within the study area, a growth rate of 29 percent is expected by the year 2020.

Table 3-1. Population Projections in Yuba County

Area	1995	2020	Percent Increase
Yuba County	64,100	105,361	65
Beale Air Force Base	9,137	12,648	38
Foothills	5,101	7,410	45
Linda	14,102	25,468	80
Loma Rica	6,836	13,591	98
Marysville	13,229	15,224	15
Olivehurst	9,610	11,450	19
Wheatland	2,859	5,378	88
Plumas - Arboga	3,226	14,191	339

Source: SACOG.

The primary components of the Yuba County economic base are agriculture and related activities, the military (Beale Air Force Base), retail trade, professional services (consisting primarily of health and educational services), and construction and manufacturing (see Table 3-2). Agricultural employment in Yuba County actually increased during the period of 1980-1990, in contrast to other predominantly agricultural counties.

Beale Air Force Base is located about 15 miles east of Marysville and encompasses 23,000 acres in Yuba and Nevada Counties. Beale is an Air Combat Command base with U-2, T-38, and SR 71 aircraft, and the base's mission is world-wide, high altitude reconnaissance. The base has a population of just over 7,000, including active duty members and their families. There are about 540 civilian workers on the base, and a large number of retirees have settled in the surrounding communities. These communities provide employment, housing, shopping, recreation, and cultural activities for the base population (SITES, 1997).

A large number of Yuba County residents work outside of Yuba County, and the number is increasing. Of those employed, 23.6 percent worked outside the county in 1975, 26.6 percent in 1980, and 37 percent in 1990. While many of those working in another county commute to Sutter County, an increasing number of Yuba County residents commute to Sacramento for employment.

The State Employment Development Department is responsible for reporting and projecting industry and labor force within the State. An annual report titled

Table 3-2. Employment by Industry in Yuba County

Industry	Number of Employees
Agriculture, forestry, fishing, mining	1,786
Construction	1,679
Nondurable goods manufacturing	695
Durable goods manufacturing	1,266
Transportation	885
Communications and other public utilities	440
Wholesale trade	500
Retail trade	3,307
Finance, insurance, and real estate	879
Business and repair services	844
Personal, entertainment, and recreation services	705
Health services	1,425
Educational services	1,553
Other professional and related services	1,189
Public administration	1,176

Source: 1990 Census.

Projections and Planning Information: Yuba County is prepared and provided for public release. The report for the study area combines Yuba and Sutter Counties. Although the employment projections are a combined total for both counties, they are representative of the anticipated growth in Yuba County. According to the Department, employment in Yuba and Sutter Counties is expected to expand at a rate of 8.7 percent from 1992 to 1999. Retail trade is projected to grow at 20 percent during the projection period. Manufacturing employment is projected to increase at an overall growth rate of 12.1 percent, mainly in the food processing industry (CEDD, 1995).

The average cost of homes in Yuba County varies greatly by area. Home prices range from $30,000 to over $200,000. Because the values are so different, the County Assessors Office does not provide an average home value for the county. The housing value in the county has gone down over the last 5 years. Homes that sold for $135,000 in 1992 are now valued at about $105,000. However, this decrease in housing value is not limited to the Yuba County area. Housing values have decreased throughout the State. There are currently 22,364 housing units in Yuba County. Within the study area, there are 12,806 housing units, including single family, multiple family, and mobile homes. By the year 2020, the total number of housing units in Yuba County is expected to increase by 41 percent, for a total of 38,216 units.

Fire protection in Yuba County is provided by several agencies, reflecting the fact that there are city, county, State, and Federal lands and privately owned lands in the county. Yuba County does not operate a county fire department. Consequently, the various communities within the county have organized their own fire protection. Unincorporated areas are provided with fire protection by nine fire districts, community services districts, or public utilities districts. The Linda Fire District provides fire and rescue service and maintains two stations. Including volunteer staff, Linda has 35 fire fighters. The Olivehurst Public Utility District maintains a fire station in Olivehurst, which is staffed by a total of 23 personnel including one full-time chief, one full-time fire fighter, and 21 part-time fire fighters. The Marysville Fire Department provides fire protection within the city limits. The Department is staffed by 25 paid fire fighters on a 24-hour basis. The State Department of Forestry generally provides fire protection in the unincorporated foothill and rural portions of the county that fall within the responsibility of the State. Although their main responsibility is to fight wildland fires during the fire season, the Department of Forestry responds to all fires, including structural fires, because structural fires can potentially evolve into wildland fires.

The Yuba County Sheriff's Department, headquartered in Marysville, provides law enforcement and police protection throughout the unincorporated area of the county. The current staffing ratio of sworn personnel to the service area population is about 1.38 officers per 1,000 people. This exceeds the commonly applied standard of 1.00 per 1,000. The incorporated city of Marysville is provided law enforcement services by the Marysville Police Department. The Department currently has 23 full-time sworn personnel and maintains 15 vehicles. The staffing ratio is about 1.78 officers per 1,000 people.

The primary general public waste disposal site for Yuba County is the sanitary landfill on State Route (SR) 20 near the northeast corner of the city of Marysville. The facility is owned and operated by Yuba-Sutter Disposal, Inc., and

is the sole authorized collector of residential and commercial refuse in Yuba County.

The Yuba-Sutter bi-county area is serviced by two acute care hospitals with a total capacity of 240 beds, one emergency medical center, and two health clinics. The Peach Tree Clinic in Marysville is a county facility that provides comprehensive health care services to MediCal, Medicare, and private patients in Yuba County. Rideout Memorial Hospital, located in Marysville, is a licensed, accredited, non-profit community hospital offering acute care and skilled nursing care. The hospital maintains medical, surgical, pediatric, and intensive care/cardiac care services along with its fully-staffed 24-hour emergency center.

Yuba County has six school districts, each with its own board of trustees. The school districts are:

- Camptonville Union School District
- Plumas School District
- Wheatland School District
- Wheatland Union High School District
- Marysville Joint Unified School District
- Yuba Community College District

The county has 19 public elementary schools, five public junior high or intermediate schools, three public high schools, one continuation high school, and one community college. During the 1990-91 school year, the schools in Yuba County were not at capacity. However, with the estimated growth in the county, these schools will be at capacity and possibly over capacity. The Marysville Joint Unified School District is awaiting funding for expansion from the State Allocation Board, and the District may need to alleviate its overcrowding problem by placing many K-6 students on a year-round education calendar. The District may also impose developer fees on new development.

The following districts provide domestic, commercial, and/or irrigation water to the unincorporated areas of Yuba County:

- Brophy Water District
- Browns Valley Irrigation District
- Camp Far West Irrigation District
- Cordua Irrigation District
- Linda County Water District
- Wheatland Water District
- Yuba County Water Agency
- Yuba County Water District

- Hallwood Irrigation District
- South Sutter Water District
- Olivehurst Public Utility District

Marysville is supplied water from the California Water Service Company. With the exception of the older portions of central Marysville, the water distribution system is reported to be in good condition. The Yuba County Subdivision Ordinance (Chapter 11.15, Section 400) provides that a subdivider must provide public water facilities if such facilities are available to that subdivision.

Construction of the project would not affect the socioeconomic conditions in the three reaches. Residential, commercial, industrial, and agricultural development would continue according to City and County General Plans and regulations. The growth rates, employment opportunities, and housing values would be determined by local government regulations, as well as regional economic conditions. New public facilities such as schools and parks would be constructed to support the planned increase in population. In order to continue adequate county services to the area, the Yuba County Board of Supervisors adopted public facilities fees in 1992. These fees are imposed on new development and will help pay for existing and new services provided by the county.

3.2.7 Recreation and Esthetics

Recreation

Yuba County has about 572 acres of neighborhood and community park and recreation facilities that are accessible to the public. Of the 572 acres, 267 acres are within the city of Marysville and include Riverfront Park, Ellis Lake, and scattered neighborhood parks. Riverfront Park includes soccer fields, driving range, motocross racing facility, picnic tables, baseball diamonds, amphitheater, and boat launching facilities. Ellis Lake includes a walking path and picnic tables. Additionally, there are 13 acres of neighborhood parkland in Olivehurst, 75 acres of park facilities within the east Linda area, and 29 acres of east and west Linda Parks. The only established public recreation area in reach 2 is the Star Bend Recreation area, located at Star Bend on the Feather River. The 9-acre site is maintained by Yuba County and provides a boat launch ramp and minimal day-use facilities. In the study area, the Yuba and Feather Rivers are used for fishing, picnicking, rafting, tubing, and swimming when access is available. There is also some unauthorized off-road vehicle use. The tops of the levees are often used for bicycle riding, walking, and jogging.

Levee improvement work along the Yuba and Feather Rivers would not significantly affect recreation use in the area. Most of the recreation use takes

place in or near the river, mainly swimming, picnicking, and off-road vehicle use. Activities that take place on top of the levee such as bicycle riding, jogging, and walking would be temporarily interrupted during construction. However, the top of the levee would be returned to its pre-project condition, and these activities could resume after construction is completed. These temporary effects are not expected to be significant.

In reach 3, there would be some temporary effects to recreation use during construction. In the Yuba River/Jack Slough area (LM's 0.00 to 3.25), there is walking, jogging, and bicycle use on the top of the levee. This use would be temporarily interrupted during construction. At Riverfront Park, portions of the Bizz Johnson Road surface would be disturbed during construction although one lane would remain open to traffic. After construction is completed, the road would be returned to pre-project conditions. Use of the baseball diamonds may also be disrupted during construction, but this effect would also be temporary. These temporary effects to recreation use in reach 3 are not expected to be significant.

Esthetics

An area's visual character is determined by the variety of the visual features present, the quality of those features, and the scope and scale of the scene. The visual components of a particular area consist of such features as landforms, vegetation, manmade structures, and land use patterns. The quality of these features depends on the relationship between them and their scale in the overall scene.

In assessing the esthetic effects of a project, the visual sensitivity of the site must be considered. Areas of high visual sensitivity are highly visible to the general public. Scenic highways, tourist routes, and recreation areas generate sensory reactions and evaluations by the observer. The evaluations of a particular scene will vary depending on the perceptions and values of the observer. The determination of significance of potential esthetic effects is based on the change in visual character as determined by the obstruction of a public view, creation of an esthetically offensive public view, or adverse changes to objects having esthetic significance.

The study area is in the valley region which has its own unique esthetic qualities, but the rivers and their associated vegetation are the predominant esthetic resource. The valley portion of the study area is characterized by orchards, crop lands, and the urban areas of Marysville, Olivehurst, and Linda. Visually, the rivers provide a focus for these towns and give them their unique character. The riparian vegetation adjacent to the levees is visible from places in town and from SR's 99, 70, 20, and 113. The Sierra Nevada, North Coast

Ranges, and Sutter Buttes are visible from most valley locations except when weather or air quality conditions reduce visibility.

Along the Yuba and Feather Rivers, the proposed slurry wall, levee raising, berm, and berm/drain work would not result in any significant permanent adverse visual effects with any of the project alternatives. The completed slurry wall work, which is inside the levee, would not be visible. Levee and berm raising would range from 0.5 foot to 3 feet. The land uses adjacent to the levee in this reach are generally agricultural and industrial with very few residential areas. As a result, the project levees in the construction areas are not a significant feature in the public viewshed, and the berm and levee raising would not result in a significant adverse effect. Generally, the berm/drain work consists of modifying existing berms and drains. Since the modifications would be to existing features and the levees are not a significant feature of the public viewshed, the berm and drain modifications would not result in a significant adverse effect.

Construction activity such as the operation of heavy equipment and material storage would change the visual character of the area. The construction equipment would also be visible from some local roadways. However, these effects would be temporary and would not be significant. Along the Yuba River in reach 1, there is recreational use of the river by off-road vehicles and swimmers. The construction activities would be visible to these recreationists on a temporary basis, although most of the construction would take place on the top or on the landside of the levee. There would be no permanent adverse visual changes for waterside recreation users. The borrow/disposal site in reach 2 is currently designated as a stormwater detention basin by local land use plans. Therefore, it is assumed that the visual effects of excavating the site were addressed during development of local plans.

Since the proposed work would take place on the waterside of the levee, there would be no significant permanent visual changes in the viewshed from the landside of the levee with either alternative. There are residential and business areas adjacent to the landside of the ring levee around Marysville. The waterside slurry walls would be installed from the waterside of the levee and would not be visible after construction is completed. The berms would be a permanent feature but would not be visible from the landside of the levee; therefore, the berms would not result in a significant visual effect. Construction activities would change the visual character for the residents and businesses on the landside. However, these changes would be temporary and would not be significant.

There is recreational use of the levees along the Feather River/Jack Slough in reach 3 and at River Front Regional Park. The berms along the levees would be visible to people recreating on the levees and in this park. These berms should not

be a significant visual change because they would be vegetated with grasses similar to the existing levees and because the berms would not obstruct a public view or create an offensive public view. Therefore, construction of the berms would not result in a significant adverse effect.

3.2.8 Hazardous, Toxic, and Radiological Waste

A survey of potentially hazardous and toxic waste (HTRW) sites was conducted by the Corps for Phase II of the System Evaluation in March 1992. Results of the survey were included in a report, which is on file at the Sacramento District Office of the Corps. Some of the construction sites for the Phase II work correspond with potential construction sites in reaches 1 and 2 for this feasibility study. Before any flood control project is constructed, a site-specific survey for potential HTRW sites would be necessary for the areas not covered by the Phase II work. Following are examples of the types of HTRW that may be found in the construction, staging, and borrow/disposal areas for this study.

About 35 sites were discovered, and many of these sites will be remediated for the Phase II work prior to the levee improvement work proposed in this study. The Phase II construction sites were surveyed by foot or bicycle for aboveground storage tanks, 55-gallon drums, stained soils, and peculiarly dying vegetation. Nearby streets were surveyed for possible off-site polluters such as oil suppliers and distributors, crop dusting firms, gas stations, or any company or farm with underground storage tanks. Possible off-site polluters were documented due to the possibility of contaminant plumes in the soil or the presence of ground water underneath the HTRW.

These 35 sites included empty pesticide containers stacked against the levees, aboveground storage tanks, 55-gallon drums of unknown content, and potentially off-site polluters such as nearby industry whose activities may have caused soil and/or ground-water contamination. The survey identified and described the sites and gave recommendations and cost estimates for handling the waste.

Most of these sites were created due to poor housekeeping practices of the landowners or operators. Old storage tanks and drums were stockpiled or deposited on or near the levee. These areas are on private property, and according to Yuba County regulatory agencies, the landowner is the responsible party for waste on his property. Therefore, the Phase II study recommended that the non-Federal sponsor work with the appropriate county agency to have the owner remediate the sites. If HTRW sites are identified in work areas not covered in the Phase II survey, the appropriate county agency would work with the owner to remediate the sites. The primary agencies with regulatory responsibility for

managing HTRW are the U.S. Environmental Protection Agency, State of California Emergency Services Office, and Yuba County Emergency Services.

An environmental site assessment for potential HTRW sites was conducted by the Corps in September 1997. This assessment covered two sections of levee along the east bank of the Feather River and about 5 miles of ring levee around Marysville. A 100-foot corridor on either side of the levee crown was surveyed to try and identify all possible HTRW sites that could affect the project. Based on a literature review, discussions with local agencies, and a field visit, seven sites were identified that may require further investigation. Sites along the Feather River levee included (1) a burn barrel, scattered garbage, and pruning refuse, (2) garbage dump, two vehicle gas tanks, and two blue plastic drums, (3) large dump site, and (4) vehicle maintenance area. Sites along the Marysville ring levee included (1) the abandoned Hollywood Trailer Court, (2) Yuba River Sand Company, and (3) a pole-mounted transformer at the waterside toe of the levee. Although no HTRW contamination has been confirmed, the report recommended further investigation of all sites except the trailer court and the pole-mounted transformer. This report is included in an appendix to the Feasibility Report.

3.3 AFFECTED ENVIRONMENT

This section describes baseline conditions for the significant resources in the study area. This information is compared to predicted conditions with the proposed project in place. The results or project-related effects are discussed in Chapter 4.

3.3.1 Land Use

This section describes the existing land use in the Yuba River basin study area. Sources of information in this section include the Yuba County General Plan and local land use maps.

Generally, land uses in the Yuba County are agriculture, forested lands, open space/grazing lands, urban, and a military installation (Beale Air Force Base). Agriculture is the most extensive land use in Yuba County; about 68 percent of the total county area is composed of agricultural croplands and pasture. Nearly 279,000 acres of land are used for farming and grazing in the county, of which 198,000 are grazing land in the foothill areas and 80,943 acres are farmland, predominantly on the valley floor. The predominant urbanized areas are the incorporated cities of Marysville and Wheatland and the unincorporated communities of Linda and Olivehurst. Linda is divided into east and west areas by SR 70.

Many agricultural counties have implemented the Williamson Act (California Land Conservation Act), which reduces property taxes on qualifying agricultural land in exchange for a commitment from the landowner not to develop the land for uses other than those compatible with and supportive of agriculture. Yuba County has chosen not to participate in this program. However, the Yuba County Board of Supervisors has adopted a consumer disclosure ordinance that declares it to be in the public interest to preserve and protect agricultural land and operations for agricultural use. The ordinance finds that "...residential development adjacent to such land and operations often leads to restrictions on such operations to the detriment of these uses and economic viability of the County's...agricultural industries as a whole."

Reach 1 - Yuba/Feather River

Land uses in the Linda/Olivehurst area are primarily urban community with residential, commercial, industrial, public, and open space uses (see Table 3-3). Urban development in both communities is centered around the State highways. Linda is centered around SR 70, and Olivehurst is centered around SR 65.

In Linda, residential uses consist of 2,346 single family dwellings, 1,163 multiple family dwellings, and 158 individual mobile homes, as well as four mobile home parks. A variety of commercial uses are located primarily along North Beale Road. Yuba College and three schools (two elementary schools and one middle school) are located in this community. There are also five parks, 12 churches, a golf course, and a fire station.

Prior to being inundated during the 1986 flood, the Peach Tree mall in Linda was one of the largest retail centers in the greater Sutter-Yuba region. The mall has never been fully repaired and is now only partially occupied by a movie theater, discount grocery outlet, a few State offices, and public health clinic.

Residential uses in Olivehurst include 2,260 single family dwellings, 366 multiple family dwellings, 177 individual mobile homes, and two mobile home parks. A variety of commercial uses are located primarily along Olivehurst Avenue. The Yuba County Airport and Airport Industrial Parks are located in the southwestern portion of Olivehurst. Five schools (three elementary, one middle school, and one high school), four parks, 15 churches, a post office, and a fire station are also located in the community.

Table 3-3. Land Use Acreage (1996)

Linda		Olivehurst	
Land Use	Acreage	Land Use	Acreage
Residential	1,660	Residential	1,082
Industrial	63	Mobile Home Park	32
Public	14	Retail Commercial	52
Retail Commercial	70	Service Commercial	12
Service Commercial	106	Industrial	62
Private Institutional	20	Private Institutional	15
		Public	936
Total	1,933	Total	2,191

Source: Yuba County, 1994.

Beyond the urban development, most of the land is open space and agricultural. Directly adjacent to the project area, most land is agricultural. However, there are some residential properties and a small motel where SR 70 crosses the Yuba River. The staging area in this reach of the project is a 15-acre agricultural field.

According to the Yuba County General Plan, growth in the county will be planned in a fashion to maintain valuable agricultural lands. A variety of living environments will be preserved, ranging from higher density urban areas within and near present communities to rural large lot densities within areas of the county more remote from services. Established communities will be the focal point for foothill and mountain growth and will take on a village character, with a higher density core providing goods and services to surrounding areas. Densities will decrease with distance from the village core. When consistent with the village concept, clustering of housing will occur, with green space retained in large blocks for use and enjoyment by homeowners. Rural residential areas will be preserved, recognizing the need to provide for a variety of lifestyles. On the valley floor, lands that are the least productive for agricultural purposes will be committed to development while higher value agricultural land will be protected from encroachment and preserved. Future development is planned in east Linda and the

Plumas Lake area. This development is on the east side of Feather River Boulevard and not directly adjacent to the Yuba River levee.

Reach 2 - Feather River

In this reach, there is a considerable amount of land between the Feather River and the existing levee. In some areas between the river and the levee, riparian vegetation has been removed to allow planting of crops, primarily orchards. A typical pattern in this area is a band of riparian vegetation along the river's edge, bordered by plots of orchard and then a berm. The distance between the orchard and the toe of the levee varies greatly along this reach of the river. The predominant use on the landside of the levees is orchards. There is only limited residential development adjacent to the levees. Occasionally, two to three residential units are clustered at the end of one of the few county roads which connect to the levees. On the east side of Feather River Boulevard, the Plumas Lake development is under construction. This area consists of large single family homes. The land use of the borrow/disposal site in reach 2 is a fallow agricultural field.

The only public recreation area on this segment of the river is the Star Bend Recreation Area, located at Star Bend on the Feather River. This 9-acre site is maintained by Yuba County for public use and contains a boat launch ramp and minimal day-use facilities.

Reach 3 - Marysville Ring Levee

The levees in this reach surround Marysville. Land use in this area is urban on the land side of the levee and orchards and Riverfront Park on the waterside. The waterside of the levees is also the floodway for Jack Slough and the Yuba and Feather Rivers. The State Department of Fish and Game (DFG) maintains small wildlife areas for the city of Marysville near Jack Slough. Most of the area within the Marysville city limits has been developed. There are approximately 22 acres of residential land and 10 acres of commercial/industrial land that have not been developed. The staging areas for this reach are nonnative grasses and forbs.

3.3.2 Transportation

The following section describes the existing roadway functions, traffic volumes, traffic levels of service, airports, rail service, transit, and bicycle routes that may be affected by the proposed project. Yuba County is served by a system of State highways and county roads. The State highway system consists of both controlled access freeways and conventional highways. The county roadway

system is composed of "major" roads, "collector" roads, and "local-residential" streets. County roadways are further classified as "urban" or "rural" facilities.

County roadway classifications are defined below. In general, the majority of county roadways have been constructed to meet the relatively low volumes of traffic historically experienced in rural Yuba County, and have not been constructed to the ultimate section as identified by the current roadway classifications.

Major Roads: Ultimately, major roads within Yuba County will be divided highways with a center median. A 100-foot right-of-way is designated, with a 64-foot pavement section in rural areas and an 86-foot section, capable of providing on-street parking, designated in urban areas. Both sections provide four travel lanes and a center median.

Collector Roads: Collector roads in Yuba County have an 84-foot right-of-way in urban areas. A 64-foot pavement section is provided, and collector roads are capable of providing four travel lanes with parking, or, by eliminating parking, five lanes through intersections. In rural areas, a 40-foot pavement section is designated, providing two travel lanes and on-street parking or, at intersections, three travel lanes.

Local-Residential Streets: In Yuba County, residential streets are constructed within a 60-foot right-of-way. The pavement section in urban areas is 40 feet, with on-street parking. A 28-foot pavement standard is used in rural areas.

State Highways

Four State highways traverse Yuba County. SR's 65 and 70 provide north-south circulation through the western portion of the county and through the city of Marysville. SR 49 provides north-south circulation through the extreme eastern edge of the county. SR 20 is the only east-west highway in the county, intersecting SR 70 in Marysville and extending east into Nevada County. SR 70, which extends through reach 3, is a two- and four-lane highway which extends from SR 99 in Sutter County to the Butte County line. The roadway is classified as conventional highway, expressway, and freeway over various segments. SR 70 connects Marysville and other northern regions with the Sacramento metropolitan area. SR 20 extends around the west boundary of reach 3 and through rural Yuba County. This route is a two-lane highway which transitions from flat to rolling terrain in the west to mountainous in the east as the road extends into Nevada County. In the city of Marysville, much of the route provides four travel lanes. Traffic counts published by the State Department of Transportation range from an average daily traffic volume (ADT) of 3,900 west of Hammonton-Smartville Road

to 9,000 ADT at the east Marysville city limit, and 37,500 ADT at the Feather River Bridge in Marysville. The majority of SR 20 through Yuba County is designated as a conventional highway, with short segments of expressway classification.

The State Department of Transportation reports ADT's on SR 70 from 8,700 ADT at the Butte County line to 51,000 ADT at the Feather River Bridge. Traffic volumes south of Marysville range from 10,200 ADT at the Sutter County line to 26,000 ADT north of Olivehurst Avenue.

County Roadways

Existing roadways throughout the county are primarily composed of two-lane rural facilities reflecting the rural nature of the county. Many of the two-lane roads are designated as future major or collector roads. The following roads are discussed because they may be affected by some phase of the proposed project.

The following routes within Yuba County are designated as major roads, although many have not been constructed to more than two lanes. Ultimately, the current Circulation Element of the General Plan indicates that these routes will be divided highways with a landscaped median.

Simpson Lane: From the city of Marysville to the proposed SR 70 bypass of Marysville. Currently, Simpson Road links Ramirez Road in Marysville to Hammonton-Smartville Road in the east.

Feather River Boulevard: From North Beale Road south to SR 70. This was once the main highway to Sacramento. Feather River Boulevard now serves west Linda and the industrial and agricultural areas in southwest Yuba County. This road carries from 1,600 ADT north of Broadway to 4,800 ADT south of Grand Avenue. The roadway terminates at an at-grade intersection with SR 70 and has a paved width of 22 feet with a wide unpaved shoulder. Feather River Boulevard also provides access to the developing industrial area south of the Yuba County Airport, and trucks use this road on a regular basis.

The following roads are collector roads, which collect traffic and route it to major roads or freeways. In the urban area, they play a major role in serving the industrial, commercial, and high density residential areas.

Jack Slough Road: From the Marysville city limits north of West Hallwood Boulevard. This is the main north-south street to serve the potential

expansion of the city of Marysville in this area. The roadway currently carries 400 to 600 ADT.

Arboga Road - Broadway: From McGowan Parkway south to Feather River Boulevard. This road is currently two lanes and connects Feather River Boulevard with Plumas-Arboga Road. Current volumes on Broadway range from 400 to 600 ADT.

Hammonton-Smartville Road: From Simpson Lane east to Griffith Avenue.

Simpson Lane: From SR 70 southeast to North Beale Road via a new segment south of the Southern Pacific Railroad tracks.

Because of the special scenic qualities of certain areas of Yuba County, roads crossing scenic areas are recommended in the current Circulation Element for protection by special ordinances to enhance scenic view sheds. In the study area, SR 70 and Feather River Boulevard south of Country Club Road have been recommended as scenic corridors.

To assess the quality of existing traffic conditions throughout Yuba County, levels of service have been identified for major roadway and collector facilities throughout the county and major intersections which experience significant traffic volumes. "Level of Service" (LOS) is a qualitative measure of traffic conditions where a letter grade "A" through "F" corresponding to progressively worsening traffic conditions is assigned to an intersection or roadway segment. An "A", "B", and "C" LOS are considered satisfactory to most motorists, while LOS "D" is marginally acceptable. LOS "E" and "F" are associated with congestion and delay and are unacceptable to most motorists. Current evaluation methodology depends on the physical characteristics of the roadway segment or intersection and can also be categorized as "urban" or "rural."

Current roadway and intersection operations that may be affected in the study area are summarized in Tables 3-4 and 3-5. Current traffic operations on major and collector roads are identified. The LOS is based on urban versus rural conditions, and the reported level of service in rural areas assumes either level or rolling terrain. Additionally, Table 3-6 displays operations on the State highway system that may be affected by the project.

Table 3-4. County Levels of Service

Major/Collector Roads	Location	Current Daily Traffic	Pavement Width (ft)	Level of Service
Simpson Lane	Ramirez Road to Hammonton Smartville Road	N/A	N/A	N/A
Feather River Boulevard	N. Beale Road to SR 70	1,400 to 16,300	22	A/B-U[1]
Collector Roads				
Jack Slough Road	Marysville city limits to Woodruff Lane	600	22	A-RL[2]
Arboga Road	McGowan to Broadway	3,700	22	A-U
Broadway	Arboga to Feather River Boulevard	400	22	A-U
Hammonton-Smartville Road	Simpson Lane to Griffith Avenue	4,500	22	A-U

[1]Urban conditions.
[2]Rural level terrain.

Table 3-5. Existing PM Peak Hour Levels of Service at Intersections

Intersection	Traffic Controls	LOS	V/C[1]	Reserve Capacity
12th Street/B Street (Marysville) (SR20/SR70)	Signal	B	0.68	N/A
5th Street/E Street (SR70)	Signal	C	0.71	N/A
3rd Street/E Street (SR70)	Signal	B	0.62	N/A
North Beale Road/Feather River Boulevard	Signal	A	0.46	N/A
North Beale Road/ Hammonton-Smartville Road	Signal	A	0.52	N/A
Feather River Boulevard/Arboga Road	Stop Sign	B	0.52	N/A

[1]Volume to capacity ratio.

Table 3-6. State Highway Levels of Service

Facility	Location	Current Daily Traffic	Facility Class	Level of Service
State Route 20	Sutter/Yuba County line	37,500	4E	E
	Junction SR 70	26,500	4C	D
	Marysville city limits	21,000	2C	D
	West of Loma Rica Road	8,200	2C	D
	West of Marysville Road	6,800	2C	D
	West of Hammonton-Smartville Road	3,900	2C	D
	Nevada County line	5,800	2C	E
State Route 70	Sutter County line	10,200	2E	D
	North of McGowan Parkway	12,200	4F	A
	North of Olivehurst	26,000	4F	B
	North of Beale Road	51,000	4F	C
	South of SR 20	30,000	4C	E
	14th Street Marysville	18,800	2C	E
	24th Street Marysville	11,400	2C	E
	Butte County line	8,700	2C	D

Generally, traffic operations are good on the county roads which serve rural Yuba County but deteriorate to relatively unacceptable levels in some developed urban locations. For example, the LOS on SR 70 is very good on the freeway south of Marysville, but drops to LOS E on the conventional highway through Marysville. Similarly, SR 20 also operates at LOS D through Marysville. Most rural Yuba County roads currently carry traffic volumes ranging from 1,000 to 3,000 ADT. As a result, satisfactory levels of service are achieved.

Airports

Yuba County is served by three airport facilities: Beale Air Force Base, Yuba County Airport, and a private, public use airstrip located near the community of Brownsville. Beale Air Force Base is a military installation. The Yuba County Airport is a modern aeronautical facility with capabilities to accommodate jet air

carriers, freight carriers, and general aviation business jets and private aircraft. The airport serves as a satellite and reliever airport to Sacramento International Airport and provides an alternative for air carriers serving Sacramento when Sacramento International and other airports are closed due to poor weather. The airport consists of 930 acres and includes 265 acres dedicated to industrial use. The Brownsville airstrip provides no tower operations and serves only general aviation.

Rail Service

Yuba County is served by several railroads providing passenger and freight service. These services are discussed below.

Passenger Rail Service: Passenger service is provided by AMTRAK, which operates an unstaffed terminal at 6th and A Streets in Marysville. This terminal provides direct access to destinations such as Los Angeles and Seattle. AMTRAK uses Southern Pacific Railroad lines in this area.

Freight Rail Service: Freight service is provided by two railroads which generally serve the urban corridor along SR's 70 and 65. Southern Pacific Railroad maintains one line which enters Yuba County near Wheatland and parallels SR's 65 and 70 on the east, crosses the Yuba River in reach 1, and extends into Marysville. The railroad crosses the levees in reach 3 near the Catholic Cemetery, crosses Jack Slough, crosses the Feather River north of Marysville in reach 3, and continues north up the valley, paralleling SR 99. Southern Pacific Railroad also maintains spur lines which extend into the rural areas northeast of Marysville and along the Yuba River parallel to Simpson-Dantoni Road. Railroad sidings exist in Marysville in the area between 5th and 12th Streets.

Union Pacific Railroad has a mainline which also crosses the county. This line enters Yuba County along the west side of SR 70 and extends into Marysville. The line crosses the Feather River near 5th Street and extends west. The line also extends around Marysville, paralleling the levees in reach 3, and crosses the Southern Pacific Railroad and SR 70 near the Marysville City Cemetery. The line then crosses Jack Slough and extends north, paralleling SR 70. The railroad also maintains spur lines which service the industrial area near the Yuba County Airport.

Railroad grade separations for automobile crossings occur at various locations in the county. For the Southern Pacific Railroad, there are crossings at Erle Road, North Beale Road, 12th Street, and SR 70. For the Union Pacific Railroad, there are crossings at Plumas-Arboga Road, Pasado Road, Feather River Boulevard, 5th Street, 10th Street, 14th Street, and SR 70.

Transit

Public bus transportation in Yuba County is provided by the Hub Area Transit Authority. This authority serves the Marysville, Yuba City, and surrounding unincorporated Yuba County and Sutter County areas. In addition, bus service is provided to the foothill area of Yuba County, city of Live Oak, and city of Sacramento. Services such as urban dial-a-ride and Sacramento commuter routes are provided.

Bikeways

Bikeways in Yuba County consist of on-street bicycle lanes and designated routes without lanes. In September 1991, the Yuba County Board of Supervisors incorporated a Master Trails Plan into the Open Space and Conservation Element of the General Plan. The trails plan would include a network of bike paths, equestrian trails, and mountain bike trails and is intended to link various communities and people in Yuba County to the natural environment and provide recreational opportunities close to population centers. At this time, no facilities associated with this plan have been constructed.

3.3.3 Noise

Noise is often defined simply as unwanted sound, and noise levels and effects are interpreted in relationship to noise level objectives for each county. Sound is technically described in terms of loudness (amplitude) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) provides this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Several rating scales have been developed to analyze the adverse effect of community noise on people. Development of these scales has considered that the potential effect of noise on people largely depends on the total acoustical energy content of the noise, as well as the time of day when the noise occurs.

L_{eq}, the equivalent energy noise level, is the average acoustic energy content of noise during the time it lasts. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure, no matter what time of the day of night they occur.

L_{dn}, the day-night average noise level, is a 24-hour average L_{eq}, with a 10-dBA "penalty" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for the greater noise sensitivity of people at night.

Other noise measures give information on the range of instantaneous noise levels experienced over time. Examples include:

L_{max} is the maximum instantaneous noise level experienced during a given period of time.

L_{min} is the minimum instantaneous noise level experienced during a given period of time.

L_n values indicate noise levels that were exceeded "n" percent of the time. For instance, L_{50} is the noise level that was exceeded 50 percent of the time during a measurement period (for example, 30 minutes in an hour).

The existing Yuba County General Plan Noise Element was adopted in 1980 and contains objectives for acceptable noise exposure for several land use designations. The recommended noise level criteria are summarized in Table 3-7. The Noise Element does not specify if the noise level objectives contained in Table 3-7 represent maximum or average noise levels. It is not likely that the standards were intended to represent maximum noise levels L_{max} since the passage of a single car within 50 feet would exceed a 45 dB standard. It is most likely that the standards were intended to represent average hourly noise levels, or L_{eq}. Standards specified in this manner are usually applied to stationary noise sources such as mining operations, industrial processing, or heavy construction equipment.

The State Office of Noise Control recommends that a 60-dB L_{dn} is generally acceptable for exterior noise for residential units. The State office also establishes a 45-dB L_{dn} for an interior noise standard for residential units.

Typically, a community noise survey is conducted to document noise exposure in areas of the county containing sensitive land uses. However, such a community noise survey was not conducted for the existing general plan Noise Element for Yuba County. As a result, no documentation of noise levels within the county exists. However, most of Yuba County is rural and is expected to be relatively quiet. The more urbanized areas within the county are expected to have higher noise levels due to roadway traffic and other human activities.

Table 3-7. Recommended Ambient Allowable Noise Level Objectives in dB

Land Use	7 a.m. to 10 p.m.	10 p.m. to 7 a.m.
Low Density Residential	50	50
Multi-Family Residential	55	50
Schools	45	45
Retail/Commercial	60	55
Passive Recreation Areas	45	45
Active Recreation Areas	70	70
Hospitals/Mental Facilities	45	40
Agriculture	50	50
Neighborhood Commercial	55	55
Professional Office	55	55
Light Manufacturing	70	65
Heavy Manufacturing	75	70

The major noise sources in Yuba County are roadway traffic on State roadways and major arterials; railroad operations along two major railroad tracks which cross the county; aircraft operations at Beale Air Force Base, Yuba County Airport, and Brownsville airstrip; and fixed noise sources which may include industrial processing, mining, and commercial activities. People who live or work within the influence of these facilities may experience noise levels which could be considered annoying.

3.3.4 Air Quality

The air quality of a given area is determined by the amount of pollutants released into the atmosphere and the atmosphere's ability to transport and dilute the pollutants. The most important determinants of air pollution transport are wind, atmospheric stability, terrain, and insolation.

The study area is located in Yuba County, which is under the jurisdiction of the Feather River Air Quality Management District (FRAQMD). The FRAQMD has

the primary responsibility for attainment and maintenance of District-wide air quality standards. The study area is included in the Federally delineated Sacramento Valley Air Basin. The FRAQMD is also subject to regulations and attainment goals and standards of the Sacramento Valley Air Basin and the California and U.S. Environmental Protection Agencies (EPA). The standards of the State and Federal Clean Air Acts are enforced by the California and U.S. EPA's, respectively.

The Sacramento Valley Air Basin is bound by the Cascade Range on the north, the Sierra Nevada on the east, and the Coast and Diablo Ranges on the west. The study area is about 75 miles north of the Carquinez Strait, a sea level gap between the Coast and Diablo Ranges. Air enters the air basin through the Carquinez Strait and moves across the Delta, bringing with it pollutants from the San Francisco Bay area. Pollutants are carried by winds into Yuba County from the Sacramento and San Francisco Bay areas, and inversions often prevent these pollutants from dispersing.

The climate of the Sacramento Valley Air Basin is characterized by hot, dry summers and cool, rainy winters. On an average annual basis, the predominant wind direction is from the south-southwest. Mean wind speeds range from 6.6 to 9.0 miles per hour with calm winds occurring about 20 percent of the time. During the winter, periods of dense and persistent low-level fog are common between storms. Two types of inversions occur in the air basin. During late spring and early fall, a layer of warm air frequently overlays a layer of cool air from the San Francisco Bay/Delta, resulting in an inversion. Characteristic winter inversions occur when the sun heats the upper layers of air, trapping lower air that has been cooled by contact with the cooler surface of the earth during the night. Both types of inversion layers trap air pollutants near the earth's surface and prevent them from being dispersed (CARB, 1984; SMAQMD, 1994).

The major air pollution problems in the basin are high concentrations of oxidants and suspended particulate matter. Both pollutants frequently exceed Federal and State air quality standards. The largest source of oxidants is motor vehicles, and the major sources of suspended particulates are agriculture and lumber industries.

Federal and State Ambient Air Quality Standards

The Federal and State Governments have each established ambient air quality standards for several pollutants (see Table 3-8). Most standards have been set to protect public health. However, for some pollutants, standards are based on other values such as protecting crops and other materials and avoiding nuisance conditions.

The FRAQMD is in attainment for all Federal and State criteria pollutants except for the State and Federal ozone standards and the State standard for particulate matter, 10 microns in size (PM_{10}). Although the Yuba County portion of the FRAQMD is not officially recognized as a Federal attainment zone for ozone, the area has been in compliance with Federal standards since 1990. As a result, while awaiting redesignation by the EPA, the area is considered to have "transitional" status for this pollutant.

Air quality monitoring stations are located in the Agricultural Building at the Sutter County Fairgrounds and at Almond Street, both in Yuba City. These stations monitor ozone and airborne PM_{10}. Table 3-9 summarizes air quality data between 1992 and 1995, the last year for which data are available.

Ozone. Ozone, the main component of photochemical smog, is formed through a complex series of photochemical reactions between reactive organic gases (ROG) and nitrogen oxides (NO_x). Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer and fall air pollution problem. Motor vehicles are the major source of both these precursor pollutants in the air basin. The main effects of ozone include damage to leaf tissues of crops and natural vegetation, chemical deterioration of various materials, irritation of the respiratory system, and eye irritation.

Ozone is a regional pollutant. Because photochemical reactions take time to occur, high ozone levels often occur several miles downwind of precursor emissions.

State and Federal standards for ozone have been set for a 1-hour averaging time. The State 1-hour ozone standard is 0.09 part per million (ppm), not to be exceeded. The Federal 1-hour ozone standard is 0.12 ppm, not to be exceeded more than three times in any 3-year period. The EPA recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 ppm. However, areas classified as nonattainment for ozone must attain the 1-hour ozone standard. After an area has achieved attainment of the 1-hour standard, then the 1-hour standard is no longer applicable, and the area must strive to meet the 8-hour ozone standard.

Table 3-8. Ambient Air Quality Standards Applicable in California

Pollutant	Symbol	Average Time	Standard[1], as parts per million		Standard, as micrograms per cubic meter		Violation Criteria	
			California	National[2]	California	National	California	National
Ozone	O_3	8 hours[3]	N/A[4]	0.08	N/A	160	N/A	If 3-year average of annual third-highest daily 8-hour maximum exceeds standard
		1 hour	0.09	0.12	180	235	If exceeded	If exceeded on more than 3 days in 3 years
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
(Lake Tahoe only)		8 hours	6	N/A	7,000	N/A	If exceeded	N/A
Nitrogen dioxide	NO_2	Annual average 1 hour	N/A 0.25	0.053 N/A	N/A 470	100 N/A	N/A If exceeded	If exceeded N/A
Sulfur dioxide	SO_2	Annual average 24 hours	N/A 0.04	0.03 0.14	N/A 105	80 365	N/A If exceeded	If exceeded If exceeded on more than 1 day per year
		1 hour	0.25	N/A	655	N/A	N/A	N/A
Hydrogen sulfide	H_2S	1 hour	0.03	N/A	42	N/A	If equaled or exceeded	N/A
Vinyl chloride	C_2H_3Cl	24 hours	0.010	N/A	26	N/A	If equaled or exceeded	N/A
Inhalable particulate matter	PM_{10}	Annual geometric mean Annual arithmetic mean 24 hours	N/A N/A N/A	N/A N/A N/A	30 N/A 50	N/A 50 150	If exceeded N/A N/A	N/A If exceeded If exceeded on more than 1 day per year
Fine particulate matter	$PM_{2.5}$	Annual arithmetic mean[3]	N/A	N/A	N/A	15	N/A	If spatial average exceeded on more than 3 days in 3 years
		24 hours[3]	N/A	N/A	N/A	65	N/A	If exceeds 98th percentile of concentrations in a year
Sulfate particles	SO_4	24 hours	N/A	N/A	25	N/A	If equaled or exceeded	N/A
Lead particles	Pb	Calendar quarter	N/A	N/A	N/A	1.5	N/A	If exceeded no more than 1 day per year
		30 days	N/A	N/A	1.5	N/A	If equaled or exceeded	N/A

[1]All standards are based on measurements at 25° Centrigrade and 1 atmosphere pressure.
[2]National standards shown are the primary (health effects) standards.
[3]New standards effective July 1997. Eight-hour ozone standard replaces 1-hour standard after compliance with the 1-hour standard has been attained.
[4]N/A = not applicable.

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Table 3-9 shows that the ozone concentrations have not exceeded the Federal 1-hour ozone standard of 0.12 ppm during the 4 most recent years for which monitoring data are available. However, the State standard of 0.09 ppm has been exceeded several times during each year.

PM_{10}. Airborne PM_{10} is produced by stationary point sources such as fuel combustion and industrial processes; fugitive sources such as roadway dust from paved and unpaved roads and dust from wind erosion of open land; and transportation sources such as automobiles. The primary sources of PM_{10} in the study area are agricultural activities, which often create airborne dust composed of soil particles, particles of vegetation, and pesticide residues. Rice burning also contributes to PM_{10} and causes silica to become airborne, which can be harmful to lungs.

Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Few particles larger than 10 microns in diameter reach the lungs. Consequently, both the Federal and State air quality standards for particulate matter have applied only to PM_{10}. The EPA recently enacted National ambient standards for particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), also known as fine particulates. Currently, no reliable emission factors or significance thresholds have been developed for $PM_{2.5}$.

The State PM_{10} standards are 50 micrograms per cubic meter ($\mu g/m^3$) as a 24-hour average and 30 $\mu g/m^3$ as an annual geometric mean. The Federal PM_{10} standards are 150 $\mu g/m^3$ as a 24-hour average and 50 $\mu g/m^3$ as an annual arithmetic mean.

Table 3-9 shows that the State PM_{10} 24-hour and annual standards are regularly exceeded at the Yuba City monitoring site. The monitoring site has recorded no violations of the Federal annual PM_{10} standard during the 4 most recent years of record. The Federal 24-hour standard of 150 $\mu g/m^3$ was exceeded once in 1994. However, this is not considered a violation of the Federal PM_{10} standards because those standards allow one violation per year.

Conformity

The Federal Clean Air Act of 1990 contains language designed to increase the stringency of Federal air quality conformity requirements. The EPA in November 1993 promulgated two conformity rules designed to implement the Federal Clean Air Act's requirements. Those rules, designed to ensure that Federal actions conform to the appropriate state implementation plan, include

Table 3-9. Summary of Ozone and PM_{10} Air Quality Monitoring Data in Yuba City (1992-1995)[1]

Pollutant	Year	Average Period	Maximum Concentration	Violations of State Standard
Ozone[2]	1992	1 hour	0.12 ppm	40
	1993	1 hour	0.10 ppm	2
	1994	1 hour	0.11 ppm	25
	1995	1 hour	0.11 ppm	19
PM_{10}[2,4]	1992	24 hours	79 $\mu g/m^3$	18.3%[3]
		Annual	35.6 $\mu g/m^3$	yes
	1993	24 hours	78 $\mu g/m^3$	15.3%[3]
		Annual	32.3 $\mu g/m^3$	yes
	1994	24 hours	154 $\mu g/m^3$	14.5%[3]
		Annual	35.7 $\mu g/m^3$	yes
	1995	24 hours	128 $\mu g/m^3$	26%[3]
		Annual	36.7 $\mu g/m^3$	yes

[1]Agriculture Building Monitoring Station.
[2]The national 1-hour standard for ozone is 0.12 ppm, and the State standard is 0.09 ppm. The national 24-hour standard for PM_{10} is 50 $\mu g/m^3$ for the 24-hour average and 30 $\mu g/m^3$ for the annual average.
[3]Percentage of monitoring days exceeding the 24-hour average.
[4]Annual PM_{10} concentrations are an arithmetic average of 24-hour monitoring results.

Source: CARB, 1995.

transportation conformity rules, which apply to transportation plans and projects, and general conformity rules, which apply to all other Federal actions.

The Corps must determine the need for and, if necessary, prepare a general conformity determination because each alternative represents a Corps action that could potentially violate the region's state implementation plan. If an alternative would produce emissions that are less than the *de minimis* thresholds established in the conformity rule, that alternative is considered exempt from the conformity rule.

3.3.5 Vegetation and Wildlife

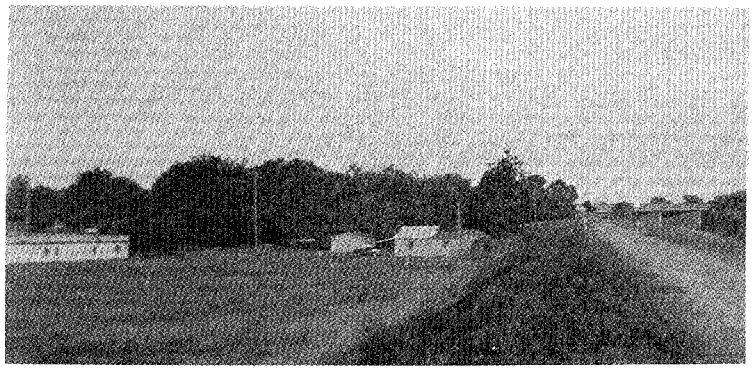
This section describes the existing vegetation and wildlife resources in the study area. Sources of information include the Yuba County General Plan, Volume 1, Environmental Setting and Background, May 1994, the U.S. Fish and Wildlife Service (FWS) Draft Coordination Act Report (CAR), September 1997, and the Sacramento River Flood Control System Evaluation Phase II - Marysville/Yuba City, Environmental Assessment/Initial Study, April 1993. The draft CAR is included in Appendix A.

Reach 1

The levees in this reach are set back from the river and support nonnative grassland vegetation with a few scattered trees. Generally, the levees in this reach are maintained regularly, and the vegetation is limited to grasses and forbs with a few scattered trees. The levee crown is generally topped with gravel and is used as a patrol road. The following species have been found on the top of the levee and on the sideslopes: Johnson grass (*Sorghum halepense*), Bermuda grass (*Cynodon dactylon*), western ragweed (*Ambrosia psilostachya*), tumbleweed (*Salsola tragus*), and yellow star-thistle (*Centaurea solstitialis*). With few exceptions, the plants are dead throughout the summer-fall dry season, persisting as seeds. Figure 3-1 shows an example of vegetation on the levee slopes and landside of the levee in this reach. The staging area is a 15-acre agricultural field with no woody vegetation. Landside vegetation is generally grassland with sparse woody vegetation or agriculture, mainly orchards. At LM's 0.35 and 0.92, there are small areas with large cottonwood trees and quail bush. This area encompasses about 0.30 acre. On the Yuba River, vegetation within the leveed portion of the river consists primarily of orchards. There are scattered areas of riparian vegetation along the Yuba River and near the confluence of the Yuba and Feather Rivers. The Feather River supports larger areas of riparian vegetation between the levees than the Yuba River.

Wildlife habitat at the levee construction sites includes the levee and the grass/forb vegetation on the crown and sideslopes and the grassland/agriculture vegetation on the landside of the levees. Common bird species along the levees include California quail (*Lophortyx californicus*), mourning dove (*Zenaida macroura*), common crow (*Corvus brachyrhynchos*), yellow-billed magpie (*Pica nuttalli*), ring-necked pheasant (*Phasianus colchicus*), and numerous raptors. These birds also use the adjacent grasslands and agricultural lands on the landside of the levee. Ground squirrels and other rodents as well as gopher snakes and western fence lizards use the grassy areas on the levee slopes and adjacent agricultural lands.

Figure 3-1. Levee Vegetation in Reach 1.



The riparian areas between the levees on both the Yuba and Feather Rivers support high value habitat for a variety of small mammals, raptors, waterfowl, and rodents.

Reach 2

The levees in this reach are set back from the river and support nonnative grassland vegetation. Generally, the levees are maintained regularly by burning, discing, spraying, and mowing; therefore, the vegetation is limited to grasses and forbs. The species would be similar to those found in reach 1. Figure 3-2 shows an example of the vegetation on the levee slope and landside of the levee in this reach. The levee crown is topped with gravel and is used as a patrol road. The staging area for this reach contains grasses and forbs similar to those on the levee crowns and slopes. This staging area would be used and disturbed during the Phase II work. The borrow/disposal site in reach 2 is a fallow agricultural field. Landside vegetation in this reach consists of grassland and agriculture, mainly orchards. Within the setback levees along the Feather River, there are extensive areas of riparian vegetation and some agricultural lands. Wildlife habitat at the construction sites includes the levee and the grass/forb vegetation on the crown and slopes and the grassland/agriculture vegetation on the landside of the levee. Common species would be similar to those described for reach 1. The riparian areas between the levees on the Yuba River support high value habitat for a variety of small mammals, raptors, waterfowl, and rodents.

Reach 3

The levees in this reach surround Marysville, and there is no native vegetation on the landside of the levee. The levees protect Marysville from flooding from Jack Slough and the Yuba and Feather Rivers, although the levees are set back from these water sources. The waterside levee slopes support nonnative grassland vegetation as described in reach 1. The levee slopes are regularly maintained, limiting the cover to grasses and forbs. There are some areas of riparian vegetation on the waterside of the levee. Scattered woodland vegetation such as cottonwoods, willows, and oaks occur within 50 to 100 feet of the toe of the levee. Figure 3-3 shows an examples of the levee slope and waterside vegetation in reach 3. There are also some agricultural lands, which are mostly orchards on the waterside of the levee. The DFG also maintains small wildlife areas for the city of Marysville near Jack Slough. The levee crown is topped with gravel and is used as a patrol road. The staging areas for this reach are vegetated with nonnative grasses and forbs similar to those on the crown and slopes.

Figure 3-2. Levee Vegetation in Reach 2

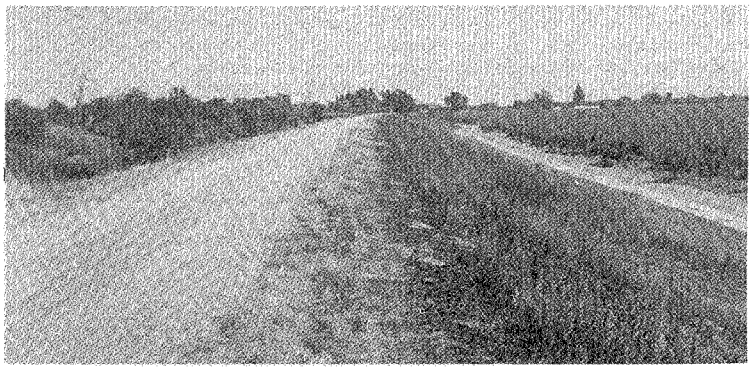


Figure 3-3. Levee Vegetation in Reach 3

Wildlife habitat at the construction sites in this reach includes the levee and the grass/forb vegetation on the crown and sideslopes and the grassland, agriculture, and scattered woodland vegetation on the waterside of the levees. Common species on the levees and waterside grassland and agriculture areas would be similar to those described for reach 1. The scattered woodland areas on the waterside of the levees are adjacent to larger riparian woodland areas maintained by the DFG. Species common to nearby riparian woodland areas such as gray fox, California ground squirrel, raccoon, ringtail, California quail, mourning dove, and red-shouldered hawk would be expected to use the scattered woodlands near the levees.

3.3.6 Special Status Species

The Federal Endangered Species Act of 1973 (FESA) (50 CFR 17) provides legal protection and requires definition of critical habitat and development of recovery plans for plant and animal species in danger of extinction. In addition, the FESA requires Federal agencies to make a finding on all Federal actions that might jeopardize the continued existence of any listed species or any species officially proposed to be listed under the FESA. The State has a parallel mandate embodied in the California Endangered Species Act of 1977 (CESA). The plant and animal species protected under FESA and CESA are listed as endangered, threatened, or, in the case of plants, rare.

In addition to formal lists of endangered and threatened species, the Federal and State Governments also maintain lists of species of special concern based on factors such as limited distribution, declining population size, diminishing habitat acreage or value, or unusual scientific, recreational, or educational value. Species of special concern are not afforded the same legal protection as listed species but may be added to official lists in the future. The two general categories of special interest species include species that are candidates for listing as threatened or endangered and species that are not candidates for listing but have been unofficially identified as species of special interest by private conservation organizations or local government agencies.

Before any Federal agency can undertake an action involving modification of the environment, FESA requires that a finding be reached by the FWS concerning the potential of that action to jeopardize the continued existence of any listed species. Unless they are also listed under FESA, species listed by the State are not protected under the Federal act. Under CESA, however, the DFG is empowered to review projects for potential effects to State-listed species and their habitats.

Special status species with the potential to occur in the study area were derived from the following sources:

- species listed, proposed for listing as threatened or endangered, or candidate species under the FESA as identified in a letter from FWS dated August 1, 1997;
- species of concern (formerly category 2 candidates for listing under the FESA);
- species listed or proposed for listing by the State as threatened or endangered under the CESA;
- a search of the DFG's Natural Diversity Database (1997);
- a literature review of other environmental documents prepared for sites in the study area;
- and a review of literature on species distribution and habitat requirements.

The resulting list is presented in Table 3-10. Table 3-10 also gives details of documented occurrences of special status species in the study area as well as information on habitat requirements and distribution.

Following the review of the information in this EIS/EIR, the Biological Assessment, and information from other sources, the FWS will issue a formal Biological Opinion including a determination of jeopardy or nonjeopardy for each species potentially affected by the proposed project. If the Biological Opinion includes one or more findings of jeopardy to the continued existence of species, the FWS would identify reasonable and prudent measures to avoid jeopardy. Based on this information, appropriate mitigation measures would be developed with the FWS by the Corps and the non-Federal sponsor. Appendix C contains a draft of the Biological Assessment.

Table 3-10. Special Status Species with Potential to Occur in the Project Area

Species	Status[1] Fed/St/CNPS[2]	Habitat Requirements	Distribution	Occurrence in Study Area
Fish				
Delta smelt *Hypomesus transpacificus*	T/--	Estuarine areas with salinities below 2 grams per liter; spawns in freshwater	Delta estuary from Suisun Bay upstream to the Delta cross channel on the Sacramento River and south along the San Joaquin and Middle River to the south end of Bacon Island	No documented occurrences in the study area
green sturgeon *Acipenser medirostris*	SC/--	Estuaries; spawns in freshwater	Widely distributed in salt water; freshwater in lower reaches of large rivers from the Sacramento-San Joaquin River system north	No documented occurrences in the study area
Central Valley steelhead *Oncorhynchus mykiss*	PE/--	Ocean and freshwater rivers and streams	In the Central Valley, most of the native, natural steelhead production occurs in upper Sacramento River tributaries below Red Bluff Diversion Dam, but these populations are nearly gone. The American, Feather, and Yuba Rivers have naturally spawning populations but have had hatchery influence in the past. The stock in the Yuba River currently receives no hatchery plants and is managed as a naturally sustained population.	Naturally spawning populations in both the Feather and Yuba Rivers
Pacific lamprey *Lampetra tridentata*	SC/--	Coastal streams and ocean	Found in most Pacific Coast streams	No documented occurrences in the study area
Amphibians				
California red-legged frog *Rana aurora draytonii*	T/CSC	Quiet, permanent water in woods, forest clearings, riparian areas, and grasslands	Coast, Transverse, Sierra Nevada, and Cascade Ranges	No documented occurrences; probably eliminated from the Central Valley

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Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status[1] Fed/St/CNPS[2]	Habitat Requirements	Distribution	Occurrence in Study Area
western spadefoot toad *Scaphiopus hammondi hammondi*	SC/--	Grasslands with shallow temporary pools	Central Valley, bordering foothills, and coastal ranges; southwestern United States	No documented occurrences in the study area; no habitat on the levees or construction areas
Reptiles				
giant garter snake *Thamnophis gigas*	T/T	Permanent freshwater, especially sloughs and marshes overgrown with tules or willows	Central Valley including Butte, Colusa, Yolo, Sacramento, Solano, San Joaquin, Stanislaus, Merced, and Fresno Counties	Potential habitat in drainage ditches in reach 3, but these areas would be avoided during construction.
northwestern pond turtle *Clemmys marmorata marmorata*	SC/--	Associated with permanent or nearly permanent water bodies with abundant cover and basking sites	Parts of Washington, Oregon, Nevada, and California; below 5,000 feet	No documented occurrences in the study area; potential habitat along Jack Slough and the Feather River
Birds				
American peregrine falcon *Falco peregrinus*	E/E	Protected edges of high cliffs, usually adjacent to marshes, lakes, or rivers that support plentiful bird populations	Nests in central and north Coast Ranges and Sierra Nevada; winters in Sacramento and San Joaquin Valleys	Reported sighting near Loma Rica northeast of the city of Marysville in 1992; possible foraging habitat in area rice fields
little willow flycatcher *Empidonax traillii brewsteri*	SC/--	Riparian woodlands along streams and rivers, in broader canyons and flood plains, around mountain meadows, mountain springs, and seepages with dense willow stands 3 to 8 feet high (breeding)	Most remaining populations nest in the Sierra Nevada and Cascades	No documented occurrences in the study area
bald eagle *Haliaeetus leucocephalus*	E/E	Coniferous forests within 1 mile of lakes, reservoirs, rivers, or creeks (nesting and roosting)	Nests primarily in Lassen, Shasta, and Plumas Counties; winters in Klamath Basin, Sacramento and San Joaquin Valleys, and along some foothill streams	Reported sighting near Loma Rica along Browns Valley Ridge northeast of Marysville; potentially forages in areas with sufficient concentrations of waterfowl such as area rice fields

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Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status Fed/St/CNPS[a]	Habitat Requirements	Distribution	Occurrence in Study Area
Aleutian Canada goose *Branta canadensis leucopareia*	T/--	Harvested corn fields and flood-irrigated fields (foraging); large marshes, flooded fields, and stock ponds (roosting)	Winters in Butte sink and then migrates to Los Banos, Modesto, and the Delta	Uses the Central Valley for roosting in winter months; potential foraging and roosting habitats in area agricultural fields and refuges
ferruginous hawk *Buteo regalis*	SC/CSC	Open grasslands in valleys and lower foothills	Southwest Canada and western U.S.; winters in southwest U.S. and northern Mexico; very localized	No documented occurrences; probably forages in study area during winter
mountain plover *Charadrius montanus*	SC/--	Short grass plains, low rolling grassy hills, freshly plowed fields, newly sprouting grain fields, and sometimes sod farms	Primarily south of the southern portion of the Sacramento Valley and on the plains and valleys on the west side of the Central Valley from about Yolo County south to Kern County	No documented occurrences in the study area; may use agricultural fields in the Sacramento area
Sandhill crane *Grus canadensis*	SC/T	Wintering habitat in agricultural lands, grain fields, stubble fields, grasslands, and open areas at edges of large freshwater lakes and rivers. Open country, usually grassy areas or wet grassy meadows and shallow marshes (breeding)	Most wintering cranes in northern California occur in the Sacramento Valley, especially in the Butte Sink area of Sutter County and Sacramento and San Joaquin Delta. Large numbers also winter locally in the San Joaquin Valley from San Joaquin County south to Kern County	No documented occurrences in the study area; winter visitor to the Sacramento area
Swainson's hawk *Buteo swainsonii*	--/T	Cottonwoods or oaks near riparian habitats (nesting); grasslands, irrigated pastures, and grain fields (foraging)	Lower Sacramento and San Joaquin Valleys, Klamath Basin, and Butte Valley	Survey reports in 1994 for the System Evaluation indicate Swainson's hawk nests in the study area along the Feather River; potential habitat in reach 3
tricolored blackbird *Agelaius tricolor*	SC/CSC	Marshes, brambles, and non-woody riparian habitats (breeding); marshes, agricultural wetlands, and feedlots (foraging)	Widespread but uncommon throughout most of the Central Valley and coastal areas from Marin County south to San Diego County	Numerous documented sightings near the study area mainly south of Olivehurst near Plumas-Arboga Road and Forty-Mile Road
western yellow billed cuckoo *Coccyzus americanus occidentalis*	--/SE	Old growth riparian forests of willow and cottonwood with a dense understory (breeding); cottonwood canopy (foraging)	Rare to uncommon, estimated 50 to 75 breeding pairs in the State, no more than 300 individuals total; 100 individuals occurred along the Sacramento River between Red Bluff and Colusa in 1974	Documented occurrences at the confluence of the Yuba and Feather Rivers in 1976 and north of Yuba City/Marysville in 1986

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Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status[1] Fed/St/CNPS[2]	Habitat Requirements	Distribution	Occurrence in Study Area
burrowing owl *Athene cunicularia*	--/SC	Drier open rolling hills, grassland, desert floor, and open bare ground with gullies and arroyos	Widely distributed throughout the lowlands of the State; formerly fairly common in the Central Valley	No documented occurrences in the study area
bank swallow *Riparia riparia*	--/ST	Open lowland habitats including farmlands, meadows, freshwater marshes, lakes, and rivers; soft bluffs or banks of sand, sandy loam, or clay for breeding	Lack of breeding sites has limited distribution; greatest number of breeding colonies occur in Shasta Valley and Klamath Basin; small scattered colonies in central California	Documented occurrences in 1985-87 in the study area along the Feather River from south of Olivehurst to North of Yuba City
white-faced ibis *Plegadis chihi*	SC/CSC	Freshwater marshes with tules, cattails, and rushes; may nest in trees and forage in flooded agricultural fields	Nests in Yolo and Colusa Counties and other isolated areas in the Central Valley; wintering concentrations in Colusa, Merced, and Yolo Counties	No documented occurrences in the study area; foraging and nesting habitat in flooded fields in the area
Mammals				
greater western mastiff-bat *Eumops perotis californicus*	SC/--	Open semi-arid to arid habitats with crevices in cliff faces, high buildings, trees, or tunnels for roosting	Uncommon in southeastern San Joaquin Valley and Coast Ranges from Monterey County south through southern California and from the coast eastward to the Colorado desert	No documented occurrences
Pacific western big-eared bat *Plecotus townsendii townsendii*	SC/--	Caves, mine tunnels, and buildings for roosts	Throughout California	No documented occurrences
small-footed myotis bat *Myotis ciliolabrum*	SC/--	Roosts in caves, buildings, crevices, mines, occasionally under bridges and under bark; occurs primarily in relatively arid wooded and brushy uplands near water	Common in arid uplands in California, coastal areas from Contra Costa County south to Mexico, and on the west and east sides of the Sierra Nevada	No documented occurrences; the study area is out of the species' range (Zeiner et al., 1990)

Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status[1] Fed/St/CNPS[1]	Habitat Requirements	Distribution	Occurrence in Study Area
long-eared myotis bat *Myotis evotis*	SC/--	Roosts in buildings, crevices, spaces under bark, and snags. Prefers coniferous woodlands and forests but occurs in nearly all brush woodland and forest habitats	Widespread in California but uncommon in most of its range; avoids the Central Valley and desert regions. Occurs along the entire coast and in the Sierra Nevada, Cascades, and Great Basin from the Oregon border south to the Coast Ranges	No documented occurrences; the study area is out of the species' range (Zeiner et al., 1990)
fringed myotis bat *Myotis thysanodes*	SC/--	Roosts in caves, mines, buildings, and crevices. Prefers pinyon-juniper, valley foothill hardwood and hardwood-conifer forests but occurs in other habitats as well	Widespread in California except for the Central Valley and Colorado and Mojave Deserts	No documented occurrences; the study area is out of the species' range (Zeiner et al., 1990)
long-legged myotis bat *Myotis volans*	SC/--	Roosts in caves, rock crevices, buildings, under tree bark, snags, and mines. Most common in woodlands and forests above 4,000 feet but also occurs in a variety of other habitats	Common in the Cascades, Sierra Nevada, and Coast Ranges; absent only from the Central Valley and desert regions	No documented occurrences; the study area is out of the species' range (Zeiner et al., 1990)
Yuma myotis bat *Myotis yumanensis*	SC/--	Roosts in caves, buildings, mines, crevices, swallows' nests, and under bridges. Prefers open forests and woodlands with sources of water over which to feed	Common and widespread in California; uncommon in the desert regions	No documented occurrences; suitable habitat may exist in the woodland areas of the Feather River
San Joaquin pocket mouse *Perognathus inoratus*	SC/--	Open, sandy areas with grasses and forbs found on shrubby ridge tops and hillsides	Found between 1,100 and 2,000 feet in the Central and Salinas Valleys	No documented occurrences
Maryeville Heermann's kangaroo rat *Dipodomys californicus eximius*	SC/--	Brushy and grassy slopes and flats of valley grassland and foothill woodland vegetation	The Heerman's kangaroo rat range includes San Francisco Bay and Amador County south to the Tehachapi Mountains.	No documented occurrences

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Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status Fed/St/CNPS[1]	Habitat Requirements	Distribution	Occurrence in Study Area
spotted bat *Euderma maculatum*	C/--	Arid country; occasionally roosts in buildings and caves	One of North America's rarest mammals; found mostly in mountains and desert regions of southern California	No documented occurrences; the study area is out of the species' range (Zeiner et al., 1990)
Invertebrates				
Sacramento Valley tiger beetle *Cicindela hirticollis abrupta*	SC/--	Generally inhabits sandbar deposits along the rivers of the Sacramento Valley. The larvae inhabit burrows in the sand that constantly retain mositure near the bottom (Graves, Krejci, and Graves, 1988).	Currently located at three sites in Sutter County: Nicolaus, Feather River, and the intersection of SR 99 and the Feather River (Graves, 1989)	No known occurrences in the study area. The project construction would not effect moist sandy areas near the river.
valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Elderberry shrubs in moist valley oak woodlands along the margins of streams and rivers	Northern San Joaquin and southern Sacramento Valleys	In reach 3, there are 3 clumps with 15 stems greater than 1 inch in diameter at ground level that would be destroyed by project construction
Sacramento anthicid beetle *Anthicus sacramento*	SC/--	Loose sandy soils occurring as dunes or along riparian areas	Sacramento, Solano, and Butte Counties	No documented occurrences; possible habitat in riparian areas
vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Vernal pools in grass or mud-bottomed swales, earth sumps, or basalt flow depression pools in unplowed grasslands	Tehama County south through most of the Central Valley and along the south and central Coast Ranges to Santa Barbara County	No known occurrences in the study area
Antioch Dunes anthicid beetle *Anthicus antiochensis*	SC/--	Loose, sandy soils occurring as dunes or along riparian areas	Antioch Dunes Preserve	No documented occurrences; no suitable habitat in the study area

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Table 3-10 Special Status Species with Potential to Occur in the Project Area - Continued

Species	Status[1] Fed/St/CNPS[2]	Habitat Requirements	Distribution	Occurrence in Study Area
vernal pool tadpole shrimp *Lepidurus packardi*	E/--	Vernal pools and swales containing clear to highly turbid water	Sacramento Valley from the Vina Plains in Butte County, south of the Sacramento area in Sacramento County, and west to the Jepson Prairie region of Solano County	No known occurrences in the study area
Plants				
Hartweg's golden sunburst *Pseudobahia bahiifolia*	E/--	Dry gravelly soils or grasslands	Low rolling hills of the eastern San Joaquin Valley from Placer County to Fresno county at elevations of 50 to 460 feet	Documented occurrence in 1990 on the north bank of the Yuba River at the junction of the Yuba and Feather Rivers
Ferris's milk-vetch *Astragalus tener var. ferrisiae*	SC/--	Alkaline flats and vernally moist meadows at elevations less than 200 feet	There have been 7 known collections of Ferris's milk-vetch, mostly around the turn of the century, from Butte, Colusa, Solano, and Yolo Counties (Bitman, 1992). The most recent collection was in Yolo County during 1978- no plants have been sited since (Liston, 1990)	No documented occurrences in the study area. No suitable habitat (alkaline flats or vernally moist meadows)
veiny monardella *Monardella douglasii ssp. venosa*	SC/--	Plains of the Feather River near Marysville	This plant was last seen in 1935 and is seldom collected; in addition to the type specimen which was collected in 1854, the only other collections known are from Butte County in 1879 and Chico Valley in 1818	No documented occurrences

[1]Key to Status:
Federal:
E = Endangered
T = Threatened
PE = Proposed Endangered
PT = Proposed Threatened
C = Candidate: taxa for which the FWS has sufficient biological information to support a proposal to list as endangered or threatened
SC = Species of Concern (formerly category 2 Candidate): taxa for which existing information may warrant listing, but for which substantial biological information to support a proposed rule is lacking

State:
E = Endangered
T = Threatened
R = Rare
CSC = California Species of Concern

CNPS:
1B = Rare or Endangered in California and elsewhere
[2]California Native Plant Society designation applies only to plants.

-- = No Listing

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Potentially Affected Species

Based on a review of the habitat requirements and study area occurrences of all the species that could occur in the study area, the species which may be affected by the proposed project alternatives are giant garter snake, northwestern pond turtle, American peregrine falcon, bald eagle, Aleutian Canada goose, Swainson's hawk, tricolored blackbird, valley elderberry longhorn beetle, and Hartweg's golden sunburst. This section briefly describes the habitat, distribution, and study area occurrences of the species that may be affected by the proposed project. Potential effects to these species are discussed in Section 4.7. The species not discussed in this section have been eliminated from further analysis because (1) they are not likely to occur in the study area due to lack of suitable habitat, (2) there are no known occurrences near the study area, and/or (3) existing habitat is far enough from the work sites that the habitat or species would not be disturbed during construction.

Giant Garter Snake (*Thamnophis gigas*). The giant garter snake is endemic to valley floor wetlands in the Sacramento and San Joaquin Valleys and inhabits sloughs, ponds, small lakes, low gradient streams, and other waterways such as irrigation and drainage canals (FWS, 1991). Habitat requisites consist of (1) adequate water during the snake's active season (early spring through midfall) to provide food and cover, (2) emergent herbaceous wetland vegetation such as cattails and bulrushes for escape cover and foraging habitat during the active season, (3) grassy banks and openings in waterside vegetation for basking, and (4) higher elevation uplands for cover and refuge from floodwaters during the snake's dormant season in the winter. Giant garter snakes typically are absent from larger rivers and other water bodies that support large predatory fish and from wetlands with sand, gravel, or rock substrates. Riparian woodlands with excessive shade do not provide suitable habitat because of the lack of basking sites and/or prey populations (FWS, 1991).

From late October to late March, giant garter snakes hibernate in abandoned rodent burrows above the high-water line. Soon after emerging from hibernation, the snakes court and mate, with snakes giving birth from July through early September (Thelander, 1994).

The historical range of the giant garter snake has been described as extending from the vicinity of Sacramento and Contra Costa Counties southward to Buena Vista Lake near Bakersfield in Kern County (FWS, 1991). Although historic records are scarce, it is believed that the historic range of the snake coincides with the historical distribution of wetlands. Habitat for the snake has been fragmented and reduced due to discing, channeling, and draining wetlands in

the Central Valley (Thelander, 1994). The current range of the giant garter snake extends from near Burrel in Fresno County northward to the vicinity of Gridley in Butte County (FWS, 1991). Unpublished studies sponsored by the DFG indicate that giant garter snake populations are currently distributed in the rice production zones of Sacramento, Sutter, Butte, Colusa, and Glenn Counties; within portions of the Yolo Bypass and Putah Creek in Yolo County; along the eastern fringes of the Delta from the Laguna Creek-Elk Grove area of central Sacramento County southward to the Stockton area of San Joaquin County; in the north and south Grasslands district of Merced County; and in the Mendota area of Fresno County.

Field visits have confirmed potential habitat for the giant garter snake in reach 3 of the study area in rice fields and water conveyance ditches on the waterside of the levee. Since current data show that giant garter snakes are currently distributed in rice production areas close to the study area, it is possible that they may occur in this portion of the study area.

Northwestern Pond Turtle (*Clemmys marmorata marmorata*). The northwestern pond turtle normally associates with permanent ponds, lakes, streams, irrigation ditches, or permanent pools along intermittent streams. Pond turtle habitat must include food sources such as aquatic plant material (pond lilies), beetles, and a variety of aquatic invertebrates as well as fishes and frogs. Basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks are also required (Zeiner, et al., 1988).

The western pond turtle is common to uncommon in suitable aquatic habitats throughout California, west of the Sierra-Cascade crest. The turtle is absent from desert regions except along the Mojave River and its tributaries (Zeiner, et al., 1988). There are no documented occurrences of the turtle in the study area; however, there is potential habitat along Jack Slough and slow-moving pools near the banks in the Feather and Yuba Rivers.

American Peregrine Falcon (*Falco peregrinus*). Habitat for the American peregrine falcon consists of nesting, perching, roosting, and foraging areas. These falcons use open ledges, caves, and potholes on high, vertical cliffs for nesting sites. The birds prefer cliffs that overlook rivers, lakes, or the ocean, where prey is abundant and there is little cover for prey attempting to escape (Thelander, 1994). The historical distribution of the peregrine falcon in California included the coastal mountains for the length of the State, the Farallon Islands, and all of the Channel Islands. In the interior, nest sites were scattered from Siskiyou County to San Diego County.

Current winter range is the entire coast from the Oregon border to the Mexican border and into adjacent mountains, valleys, and lowlands, as well as

along the entire Central Valley where the bird is scarcer than in coastal areas (Small, 1994). The falcons also occur during winter in the lowlands of the northeastern region. They are very scarce east of the Sierra Nevada crest and in the eastern and southeastern desert regions. The falcon is now rare on both the Farallon and Channel Islands (Small, 1994). Some American peregrine falcons from Alaska and Canada pass through California en route to wintering grounds in Latin America. Breeding pairs from California remain near their territories throughout the year; however, in northern California and parts of the State with high elevations, the birds migrate in winter locally along with their prey (Thelander, 1994). From late September to early May, members of this migratory population appear throughout California where suitable habitat occurs. Areas of high prey concentration such as inland marshes, riparian areas, and coastal marshes provide important foraging grounds for migrating and wintering falcons (Thelander, 1994).

From a breeding population estimated at 100 to 300 pairs in California prior to 1940, the catastrophic decline of this falcon in the 1950's and 1960's to two known nesting pairs in 1970 was largely due to the ingestion of chlorinated hydrocarbons from the bodies of their prey. Other contributing factors to the decline have been shooting, trapping for falconry, collisions with power lines, and elimination of their prey due to deteriorating habitats, particularly coastal wetlands and wetlands in the Central Valley (Small, 1994). In the study area, suitable foraging habitat occurs along the Feather and Yuba Rivers and area rice fields. The Yuba County General Plan reports a sighting near Loma Rica northeast of Marysville in 1992.

Bald Eagle (*Haliaeetus leucocephalus*). Eagle nests are typically found in multi-storied stands with old-growth components. They are always found near bodies of water which support a sufficient prey base. California eagles build their nests 150 feet from the nearest water body on average. Often times they will build alternate nests in the same territory and vary use between them in different years (FWS, 1986). Wintering habitat usually includes nearby productive forage areas, seclusion from human disturbance, and dense stands of timber for diurnal perching and nocturnal roosting (Paruk, 1987).

Historically, the bald eagle inhabited all of the North American continent and used breeding grounds on most of the continent (FWS, 1986). Breeding grounds have decreased and now only include Alaska, Canada, Pacific Northwest states, Great Lake states, Florida, and Chesapeake Bay. The winter range includes most of the breeding range but extends mainly from southern Alaska and southern Canada southward. In California, the bald eagle nests primarily in Lassen, Shasta, and Plumas Counties and winters in Klamath Basin, Sacramento and San Joaquin Valleys, and along some foothill streams. In the study area, suitable habitat occurs along both the Feather and Yuba Rivers and area rice fields. The Yuba County

General Plan reports a sighting near Loma Rica along Browns Valley Ridge northeast of Marysville.

Aleutian Canada Goose (*Branta canadensis leucopareia*). The Aleutian Canada goose uses a wide variety of habitats including pasture lands and row crops such as corn, wheat, oats, barley, and rice. Artificially impounded waters such as farm ponds, sewage lagoons, duck clubs, and small lakes, as well as intermittently flooded low lying areas, are used as roosting sites (FWS, 1982).

The Aleutian Canada goose once bred throughout the eastern and western Aleutian Islands and wintered in California and the Oregon coast. Today, despite many efforts to reintroduce it on other islands, it breeds only on Buldir Island in the western Aleutians and on Chagulk Island in the eastern Aleutians (FWS, 1982). Major use areas for wintering Aleutian Canada geese have been recognized near Colusa in the Sacramento Valley, near Modesto and Los Banos in the San Joaquin Valley, and near Crescent City (Beall, 1980). In the study area, suitable habitat occurs in the area agricultural lands, small lakes, refuges, and flooded fields.

Swainson's Hawk (*Buteo swainsonii*). In the central and northern California regions, the Swainson's hawk needs tall trees for nesting such as oaks, cottonwoods, walnuts, and willows. These trees are usually near rivers or streams adjacent to their hunting areas. Breeding Swainson's hawks need large expanses of grassland foraging habitat. A female's feeding territory may encompass 2,000 acres, and her mate can require much more territory (Thelander, 1994). Small mammals (especially voles), birds, and insects are the usual prey. In the absence of grasslands, many pairs forage in lightly grazed pasture, hay and alfalfa fields, and other agricultural lands (Thelander, 1994).

Historically, the Swainson's hawk was one of the most common birds of prey in California (Thelander, 1994). The historic range as a migrant and summer breeder included the northeastern portion of the State, Sacramento and San Joaquin Valleys, and Coast Range from Monterey County south through San Diego County (Small, 1994). The current range is the length of the State, but the hawk is very rare from the northwest coastal region south to the San Francisco Bay area. The bird remains a fairly common breeder in Modoc County, but an uncommon breeder in the Sacramento and San Joaquin Valleys (Small, 1994). Normally extremely rare in winter, the Swainson's hawk may have recently become a regular winter visitor in the Delta because of altered agricultural crops and an increase in mouse populations. Summer feeding birds have been found in Sutter, Yolo, Alameda, San Joaquin, and Merced Counties.

The Swainson's hawk population in California has decreased by at least 90 percent since 1900. In 1988, only about 550 nesting pairs were found, and the

number is still decreasing (Thelander, 1994). Shooting and unidentified problems in wintering areas have contributed to the decline, but habitat destruction is believed to be the primary cause. Due to the conversion of grasslands to agriculture, the hawk is vulnerable to crop rotation, loss of prey, loss of nest sites, and exposure to chemicals. The loss of California's riparian habitat has contributed to the loss of nesting habitat for the hawk.

Surveys were conducted for the Swainson's hawk for the System Evaluation. Swainson's hawks were observed in the study area in the past; therefore, it is likely that hawks may still occur or nest in or near the study area. There is also potential habitat for Swainson's hawk near Jack Slough on the waterside of the levees in reach 3.

Tricolored Blackbird (*Agelaius tricolor*). The tricolored blackbird inhabits open valleys and foothills and may be found in streamside forests, alfalfa and rice fields, marshes, and along reservoirs. This blackbird usually nests in marshes but may also nest in willow and blackberry thickets and on the ground in clumps of nettles. They forage in wet meadows, rice and alfalfa fields, and in rangelands. They commonly roost in trees or marshes. Whether they are roosting, foraging, or nesting, these birds are always found in very large flocks (Terres, 1980). The tricolored blackbird both nests and winters in interior valleys from southern Oregon (east of the Cascades) to northwest Baja California (Terres, 1980). Once abundant in Yolo County, the tricolored blackbird has been eliminated from the county and breeds only in a few scattered areas in California and Oregon.

There have been numerous documented sightings of the tricolored blackbird near the study area, mainly south of Olivehurst near Plumas-Arboga Road and Forty-Mile Road between SR 70 and SR 64 near Best Slough.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). The valley elderberry longhorn beetle is host specific, maturing in and feeding as adults on elderberry (*Sambuca* spp.). Little is known about the life history of the beetle; however, after eggs are laid on the foliage of the plant, the larvae bore through the pith of stems and roots of elderberry shrubs. When larvae are ready to pupate, they work their way through the pith, open an emergence hole through the bark, and then return to the pith for pupation. Adults exit through the emergence holes and then can be found on elderberry foliage, flowers, or stems, or on associated plants. The valley elderberry longhorn beetle requires established elderberry plants of mature size and age. Generally, emergence holes are found on stems less than 1 inch in basal stem diameter at ground level. The presence of exit holes in elderberry stems is evidence of previous beetle use.

The valley elderberry longhorn beetle is endemic to moist valley oak woodlands along the margins of rivers and streams in the lower Sacramento and upper San Joaquin Valleys of California, where elderberry grows. Although the entire historical distribution of the beetle is unknown, the extensive destruction of riparian forests of the Central Valley of California strongly suggests that the beetle's range may have shrunk and become greatly fragmented. There is little information on former abundance of valley elderberry longhorn beetle for comparison with current population levels. In the study area, there are three elderberry shrubs within the construction right-of way in reach 3 along the Yuba River near LM 1.0.

Hartweg's golden sunburst (*Pseudobahia bahiifolia*). This plant occurs predominantly on the northern slopes of knolls in valley and foothill grassland plant communities, but it can also occur along shady creeks or near vernal pools. Sites where this plant is found are usually characterized by a moderate to sparse cover of annual grasses associated with numerous species of native and nonnative annual and perennial forbs. In general, this plant occupies valley and foothill grasslands at altitudes between 50 to 460 feet. Historically, the Hartweg's golden sunburst was scattered and locally abundant in valley and foothill and grasslands of the Central Valley. Current known sites are concentrated in the eastern San Joaquin Valley.

There is a documented occurrence of this plant in 1990 on the north bank of the Yuba River at the junction of the Yuba and Feather Rivers.

3.3.7 Cultural Resources

The term cultural resources is broadly defined in this report as the buildings, structures, objects, sites, districts, and archeological resources associated with historic or prehistoric human activity. These cultural resources are listed in, or eligible for listing in, the National Register of Historic Places. Such properties may be significant for their historic, architectural, scientific, or other cultural values and may be of national, state, or local significance.

It is the policy of the Federal Government to use those measures, including financial and technical, which foster conditions under which modern society can coexist in productive harmony with its archeological and historic resources. Since the nation's historic properties are destroyed or substantially altered with increasing frequency, avoidance and preservation of cultural resources, to the extent feasible, is always the preferable alternative to mitigation. Likewise, the California Environmental Quality Act (CEQA) Guidelines direct public agencies to avoid damaging effects on archeological resources whenever possible (Governor's Office of Planning and Research, 1986).

Cultural Overviews

Archeological Background. Archeological investigations in the general vicinity of the project indicate prehistoric use of the area over the past 3,000 years. There is minimal evidence to indicate any earlier occupation. Previous investigations consist mainly of small surveys in the Marysville, Yuba City, and Linda urban areas (Storm, 1978), salvage excavations at the Rio Oso and Lindhurst sites (Olsen and Riddell, 1962; Prichard, 1970), and surveys completed for the Corps by Far Western in 1990 to 1993 as part of the System Evaluation.

Ethnographic Background. The project area is near the boundary area between the Konkow and Nisenan Maidu ethnographic groups. Generally, the Konkow occupied the region north of the Sutter Buttes and the Nisenan Maidu to the south. Neither group had rigid territories or leadership. Both groups had villages on natural rises along rivers and streams and subsisted on acorns and small game. Over 30 ethnographic villages have been identified along the Feather River for both groups (Riddell, 1978; Wilson and Towne, 1978).

Historic Background. The Spanish did not settle the project area; however, occasional explorations passed through. During the Mexican period, land grants were issued, encompassing most of the project area. Early pioneers were involved in ranching and farming until the onset of the Gold Rush in 1848. Although Sacramento became a hub of commerce, both Yuba City and Marysville served as trade centers for the northern mines. As the gold fields output dwindled, many miners turned to farming the rich soils of the Central Valley. As settlement increased and the populations of Yuba City and Marysville grew, the need for protection from flooding became apparent. At first, levees were built on individual properties, but by the 1900's it was clear that a regional solution was needed. The Sacramento River Flood Control Project, authorized in 1917, included levees in the project area (Bean, 1968; Hoover, 1990; Kelly, 1989; McGowan, 1961).

Methodology and Previous Studies

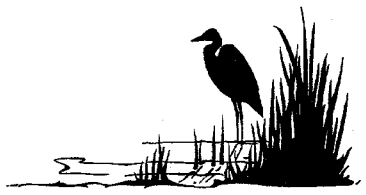
A cultural resources investigation was performed in 1989 for the Yuba River basin reconnaissance study. This investigation focused on identifying historic areas and specific historic sites using archival and other documentary sources. No field work was done during this investigation. The historic records research focused on about a 1-mile-wide corridor within the proposed levee work areas (Gilreath, Herbert, and Riggs, 1990).

Cultural resources surveys were initiated in 1990 and completed in 1993 for the System Evaluation. The survey located two archeological sites, both of which were determined to be eligible for the National Register of Historic Places. The survey also determined that the project area has a high potential for prehistoirc sites and a moderate potential for historic sites (Bouey, 1990).

The Area of Potential Effect (APE) consists of the levee reaches, a corridor of about 65 feet to the landside, the borrow/disposal site, and staging areas. Portions of the project area were not examined by previous investigations, and surveys will be required. An updated records check will be performed prior to initiating the surveys.

CHAPTER 4.0

ENVIRONMENTAL CONSEQUENCES



CHAPTER 4.0

ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter forms the analytical framework for comparing the proposed alternatives. The baseline conditions described in Chapter 3 are compared with future conditions with the project alternatives in place. The baseline and with-project comparisons show the probable consequences (referred to in this document as effects) of each alternative on significant environmental resources. The effects discussed in this chapter are organized by resource category. The resources are presented in the same sequence as Chapter 3. Each section, where appropriate, contains a discussion of the methodology used to analyze effects and the significance criteria applied to those effects. Mitigation measures to offset adverse project effects are also discussed for each resource.

A project or action can cause direct, indirect, and cumulative effects on the environment. Direct effects occur at the same time and place as the action and include effects from construction of the project, both on a short-term and long-term basis. Indirect effects are caused by the action but occur later in time or farther removed in distance, but are reasonably foreseeable. Indirect effects may include growth-inducing effects and related effects on natural systems. Cumulative effects are those which result from the incremental effect of the action when added to other past, present, and reasonable foreseeable future actions. Direct and indirect effects of the proposed alternatives are discussed in this chapter while cumulative effects are discussed in Chapter 5.

4.2 EFFECTS ON LAND USE

This section evaluates the consistency of the proposed alternatives with the types and intensities of existing and planned land uses in the study area. These land uses are designated by Yuba County in their General Plan. This evaluation includes a comparison of the consistency of the alternatives with specific land use designations and General Plan goals.

An effect would be considered significant if it would result in land uses that are incompatible with existing and planned land uses in the area, or if it would result in an inconsistency with land use designations or goals.

4.2.1 Alternative 1

The no-action alterative assumes that the Federal Government would not participate in a flood control project in the Yuba River basin study area. Land use would not change under the without-project conditions.

Reach 1 - Yuba River/Feather River

Without the project, land uses in the Linda/Olivehurst area would continue as planned in the County's General Plan. Urban development will be clustered, and productive agricultural lands will be preserved. Some lower value agricultural land will be committed to development.

Reach 2 - Feather River

The General Plan does not project any development directly adjacent to the project area. Development is planned for the nearby Plumas Lake area. However, this development will occur with or without the project in this reach. Without the project, land use in this reach will continue to be orchards with scattered residential units.

Reach 3 - Marysville Ring Levee

Without the project, land use in this reach would not change. The city of Marysville is already highly urbanized. The 22 acres of residential land and 10 acres of commercial/industrial land that have not been developed could still be developed without the project. The Riverfront Park facilities are not expected to change, and the DFG would continue to maintain the small wildlife areas for the city of Marysville.

4.2.2 Alternative 2

Project effects of the NED plan would occur due to constructing and modifying berms and drains, levee raising, and installing and modifying slurry walls.

Reach 1 - Yuba River/Feather River

With the project, land use changes will continue as planned in the County's General Plan. Slurry wall installation and modification effects would be confined to

the top of the levees and levee slopes and the effects would be temporary. Levee raising would be constructed from the landside of the levee. The increased footprint due to levee raising and berm construction and modification would result in the permanent loss of 0.30 acre of woodland habitat. The use of the land would change from woodland habitat to part of a flood control project. This change is supported by the County and would not be incompatible or inconsistent with County designations or goals. Although this is a significant loss in habitat value, it is not a significant land use change. The effects on habitat value are discussed in Section 4.6.4. Therefore, no significant changes in land use are expected under this alternative.

Reach 2 - Feather River

Under this alternative, land use in this reach would continue as planned in the County's General Plan. All work would occur either on the levee or adjacent to the levee. As a result, neither the Star Bend Recreation Area nor the orchards between the Feather River and the existing levee would be disturbed. The levee work would be constructed from the landside of the levee. The increased footprint due to levee raising and berm construction and modification would result in the permanent loss of 1.45 acres of grassland and agricultural land. The use of the land would change from grassland/agricultural to part of a flood control project. This change is supported by the County and would not be incompatible or inconsistent with County designation or goals and is therefore not considered significant. Land within the temporary easement and the staging area would be returned to its pre-construction use. The 60-acre borrow/disposal site is designated as a future stormwater detention basin by local land use plans. The use of that site by the project would not change the current land use designation.

Reach 3 - Marysville Ring Levee

All project construction would occur from the waterside of the levee under this alternative. The increased footprint due to levee raising and berm construction and modification would result in the permanent loss of 1.93 acres of woodland habitat and 12.87 acres of grassland and agricultural habitat. Although this is a significant loss in habitat value, it is not a significant land use change. The effects on habitat value are discussed in Section 4.6.4. The change in land use would be from grassland/agricultural to part of a flood control project. This change in land use is supported by the County and would not be incompatible or inconsistent with County designations or goals and is therefore not considered significant. Construction would not affect existing or planned development in Marysville.

4.2.3 Alternative 3

Project effects of this alternative would occur due to constructing and modifying berms and drains, levee raising, and installing and modifying slurry walls.

Reach 1 - Yuba River/Feather River

Effects on land use under Alternative 3 would be basically the same as under Alternative 2. Land use changes due to the project would be slightly less in reach 1 because the construction area associated with Alternative 3 would be slightly less than that described for Alternative 2. Alternative 3 has less levee improvement work than Alternative 2 because the levels of flood protection vary, 1 in 200 annual event for Alternative 3 and 1 in 250 annual event for Alternative 2. Future land use changes would continue to be consistent with the County's General Plan.

Reach 2 - Feather River

Levee improvements and construction sites would be the same as Alternative 2. Land use changes would be consistent with the County's General Plan. The effects on land use would be the same as Alternative 2.

Reach 3 - Marysville Ring Levee

Levee improvements and construction sites would be the same as Alternative 2. Land use changes would be consistent with the County's General Plan. The effects on land use would be the same as Alternative 2.

4.2.4 Mitigation

As discussed in section 4.6.4, mitigation credits from Phase II would be used to offset losses in habitat value for this project. As a result, no land would be required for mitigation. Because there would be no significant effects on land use, no mitigation would be required.

4.3 EFFECTS ON TRANSPORTATION

This section evaluates the potential effects of the proposed alternatives on transportation in the study area. This evaluation includes the roadways that may be affected by project construction due to use by construction workers, haul trucks traveling to and from construction areas, and roads that may be directly

affected by levee improvements. Potential effects could include increased traffic volumes, safety issues, parking problems, temporary disruption of use, and effects on pedestrian and bicycle facilities. There would be no adverse effects to the airport facilities.

The effects of construction of the alternatives are considered to be significant if the work causes any of the following:

- Significantly increases traffic on nearby roadways.
- Closes a roadway or blocks a travel lane.
- Blocks a transit route.
- Blocks a pedestrian sidewalk or bicycle lane.
- Closes or interferes with the operation of a rail line.
- Creates an operational safety hazard.
- Removes parking spaces in an area of limited parking or creates significant on-street parking demand where there is little or no on-street parking.
- Blocks emergency vehicle access.

The proposed project would be designed and scheduled so that construction would not close a roadway or block a travel lane, block a transit route, block a pedestrian sidewalk, disrupt the operation of any rail lines, remove parking spaces in an area of limited parking, or block emergency vehicle access. As a result, this transportation evaluation focuses on effects that could significantly increase traffic on nearby roadways, block a bicycle lane (reach 3 only), create an operational safety hazard, or create a significant on-street parking demand where there is little or no on-street parking.

4.3.1 Alternative 1

The no-action alternative assumes that there would be no Federal participation in flood control improvements in the study area. The roadways, airports, rail lines, transit service, and bicycle routes described in Section 3.3.2 would continue to connect and/or service the study area. However, traffic volumes are expected to increase as projected in the City and County General Plans. The increased traffic would be due to increased urbanization and population growth expected in the Yuba County area. Planned future transportation improvements include completing a four-lane freeway for SR 70 from the SR 99 terminus to Marysville, increasing SR 65 to four lanes from Roseville northward, constructing a third bridge crossing over the Feather River, and constructing an SR 70 bypass around Marysville.

4.3.2 Alternative 2

Reach 1 - Yuba River/Feather River

This section evaluates the effects of Alternative 2 on traffic volumes, roadway safety, and parking in reach 1 and determines the significance of any effects.

Traffic Volumes. The roadways which could be affected in reach 1 are identified and described in Section 3.3.2. To determine if Alternative 2 would significantly affect traffic volumes, the LOS for potentially affected roadways were evaluated with and without the project in place. New vehicle trips and changes in traffic volumes due to the project were considered.

The number of vehicle trips generated by project construction was estimated, including daily vehicle trips by construction workers and truck trips associated with hauling construction equipment and borrow/disposal materials. It was assumed that the work schedule would include the construction of reaches 1 and 2 in the first year and reach 3 in the second year. It is estimated that reach 1 would take 6 months; reach 2 would take 3 months; and reach 3 would take 6 months to construct. Since the work schedule could change, however, the estimated generation of trips associated with construction is conservative to accommodate changes in the construction schedule.

In reach 1, there would one construction crew working at a time. One crew of about 15 to 18 workers would install the slurry walls, and then one crew of 15 to 18 workers would modify and construct the berms and drains and raise the levees. These workers would be traveling to and from work sites each day for 6 months. In reach 2, one crew of 15 to 18 workers would travel to and from the work site for 3 months. In the second construction year in reach 3, one crew of 15 to 18 workers would travel to and from the work site each day for 6 months. Truck trips associated with hauling construction equipment would be limited to once or twice for each reach to deliver all of the needed equipment. Truck trips to haul fill to the construction sites would occur on a daily basis, and it is estimated that there would be about 160 trips a day for each reach. Some of the return trips from the construction site to the borrow/disposal site would carry backfill or disposal material.

Generally, significant traffic effects would occur when traffic volumes on a roadway increase and the roadway's operation changes from an acceptable LOS to an unacceptable LOS. In reach 1, workers would likely travel to the construction and staging areas via SR 70 south of Marysville, North Beale Road, Hammonton-Smartville Road, Simpson-Dantoni Road, and Feather River Boulevard. Some

workers would likely travel directly to the construction site while other workers would travel to the staging areas. The LOS on these "urban" roads vary from A to B. Based on current traffic volumes, the 36 worker trips per day that would be temporarily added to these roads during construction would not be likely to change the acceptable LOS on these roads to unacceptable. For example, an increase of 36 trips would represent an increase of only 0.8 percent on Hammonton-Smartville Road.

Truck trips to the borrow/disposal site would likely use Feather River Boulevard, Arboga Road, Ella Road, North Beale Road, Hammonton-Smartville Road, and Simpson-Dantoni Road. The LOS on these "urban" roads also vary from A to B. The 160 trips per day during construction to transport borrow and disposal material would not be likely to change the LOS on these roads to unacceptable. For example, this increase would represent an increase of only 3 percent on Hammonton-Smartville Road. Therefore, the effects of project construction on traffic volumes in reach 1 would not be significant.

Effects on Roadway Safety. Although project construction would not generate significant vehicle trips, construction activities may create roadway operation hazards or surface damage. At levee access points, which are generally small narrow streets, trucks moving construction equipment and bringing construction materials could pose a safety hazard. The increase in trucks accessing the levees could cause sight distance problems, and trucks would be entering busy roadways. Access points where large slow-moving trucks entering or exiting roadways may disrupt nearby traffic flow in reach 1 would include access to the south levee of the Yuba River from SR 70 and Hammonton-Smartville Road, and access to the east levee of the Feather River from Feather River Boulevard. From the borrow/disposal site, trucks entering Feather River Boulevard from Ella Road could disrupt local traffic. Generally, these effects are not expected to be significant because construction would take place during non-peak hours between 7:00 a.m. and 5:00 p.m. on weekdays and 8:00 a.m. and 5:00 p.m. on weekends. The haul trucks would generally be on the roads after the morning commute time and before the afternoon commute, during the non-peak traffic hours. Since there would be fewer vehicles on the road during the construction hours, the potential for conflicts with traffic would be greatly reduced.

No damage to the paved roadway surfaces is expected from the truck trips. If necessary, however, the contractor would return road surfaces to preproject conditions after construction.

Effects on Parking. The construction of the project would increase the demand for on-street parking near the construction sites. Construction workers

would probably park at either the staging area, on the street near the construction site, or on top of the levee. Although some vehicles would park on nearby streets, this would not be significant because the effect would be temporary, and most locations have adequate on-street parking.

Reach 2 - Feather River

The potential effects and significance of Alternative 2 on traffic volumes, roadway safety, and parking in reach 2 are discussed in this section.

Traffic Volumes. The roadways which could be affected in reach 2 are identified and described in Section 3.3.2. Daily vehicle trips for construction workers in reach 2 were estimated at 36 trips. Daily trips to and from the borrow/disposal site were estimated at 160 trips. In reach 2, construction workers would likely use Feather River Boulevard, Arboga Road, Algodon Road, and SR 70 to travel to the construction site. The LOS on these roads range from A to B. These trips per day that would be added during construction would not be likely to change the LOS of these roads to unacceptable.

Truck trips to the borrow/disposal site would likely use Feather River Boulevard and Ella Road. The 160 trips per day during construction would not be likely to change the LOS of these roads to unacceptable. Therefore, the effects of project construction on traffic volumes in reach 2 would not be significant.

Effects on Roadway Safety. Construction trucks would access the levee in reach 2 on an existing levee maintenance road near the staging area off Feather River Boulevard. There may be some conflicts with traffic on Feather River Boulevard and Ella Road when trucks are taking borrow material to or removing disposal material from the construction site. Generally, these effects are not expected to be significant because construction would take place between 7:00 a.m. and 5:00 p.m., during non-peak traffic hours. There would be fewer vehicles on the road during the construction hours, and the potential for conflicts with traffic would be greatly reduced.

Effects on Parking. In reach 2, there probably would not be any on-street parking. The construction site is relatively small and close to the staging area. The workers would likely park their vehicles at the staging area. As a result, there would be no effects to local parking in reach 2.

Reach 3 - Marysville Ring Levee

The potential effects and significance of Alternative 2 on traffic volumes, roadway safety, bicycle lane use, and parking in reach 3 are discussed in this section.

Traffic Volumes. The roadways which could be affected in reach 3 are identified and described in Section 3.3.2. Daily vehicle trips for construction workers in reach 3 were estimated at 36 trips. Daily trips to and from the borrow/disposal site were estimated at 160 trips. In reach 3, construction workers would likely use SR 70 through Marysville, SR 20, Jack Slough Road, and various streets within the Marysville city limits. The LOS on SR 70 through Marysville and SR 20 range from D to E, which can be considered unacceptable. The LOS on Jack Slough Road is A. The temporary increase in trips per day would not significantly affect any of these roads. The additional daily trips would not be likely to change the LOS on Jack Slough Road to unacceptable. SR 70 through Marysville and SR 20 already have a LOS of D and E, respectively, and these levels would not be significantly worsened with the project.

Truck trips to and from the borrow/disposal site would likely use these same roads. The temporary increase of 160 trips per day would not be a significant effect because the LOS of those roads would not change from an acceptable rating to an unacceptable rating.

Effects on Roadway Safety. Construction trucks accessing the levees in reach 3 would have a greater potential for conflicts with existing traffic than in reaches 1 and 2. Reach 3 is more urbanized than the other reaches, and many of the access points are residential streets. Large trucks on narrow residential streets could block access to homes and businesses, and the slow-moving vehicles could conflict with faster moving traffic. Trucks transporting borrow or disposal material to the construction sites could cause the same types of safety problems. These effects could be significant.

Effects on Bicycle Lane Use. In reach 3, construction would adversely affect a portion of Bizz Johnson Road in the Riverfront Park. The road is used for maintenance activities, bicycle riding, walking, jogging, and vehicle traffic. During construction, this road would likely be one-way only. Traffic would be restricted to one lane of the current two-lane road. This effect would be temporary and unavoidable. After construction, the road would be returned to its present condition.

Effects on Parking. The construction of the project would increase the demand for on-street parking near the construction sites. Construction workers

would probably park at either the staging area, on the street near the construction site, or on top of the levee. Although some vehicles would park on nearby streets, this would not be significant because the effect would be temporary, and most locations have adequate on-street parking.

4.3.3 Alternative 3

Reach 1 - Yuba River/Feather River

In reach 1, the construction area associated with Alternative 3 would be slightly less than Alternative 2. Alternative 3 has less levee improvement work than Alternative 2 because the levels of flood protection vary, 1 in 200 annual event for Alternative 3 and 1 in 250 annual event for Alternative 2. Although the levee improvements in reach 1 for Alternative 3 would be similar to Alternative 2, the heights of levee raising and berm work would be less, the depth of the slurry walls would be less, and some of the work sites would vary slightly. The construction schedule and equipment would be the same as described for Alternative 2. These differences are not expected to change the transportation effects significantly from Alternative 2.

Reach 2 - Feather River

In reach 2, the levee improvements, construction sites, construction equipment, and schedule would be the same as described for Alterative 2. The level of flood protection provided by both alternatives would be the same. The effects on transportation would be the same as Alternative 2.

Reach 3 - Marysville Ring Levee

In reach 3, the levee improvements, construction sites, construction equipment, and schedule would be the same as described for Alternative 2. The level of flood protection provided by both alternatives would be the same. Therefore, the effects on transportation are expected to be the same as Alternative 2.

4.3.4 Mitigation

Since the effects of the two construction alternatives would be essentially the same, mitigation measures in this section would apply to Alternatives 2 and 3. Implementation of these measures would reduce the effects to less than significant.

Reach 1

Parking. At construction sites with little or no on-street parking, the following mitigation measures would be implemented to reduce effects to less than significant.

- On-street parking for construction workers would be prohibited.
- Off-street parking would be identified and provided to the construction workers and their vehicles and trucks. If possible, parking would be located close enough to walk.

Reach 2

- No mitigation measures would be necessary for reach 2 because there would be no significant effects to transportation in this reach.

Reach 3

Roadway Safety. The following mitigation measures would reduce truck-traffic conflict at construction access points to less than significant.

- Construction zones along residential roadways would be posted to notify approaching motorists of trucks entering and exiting roadside construction sites and to reduce speeds through the construction zone.
- If there are trucks or equipment needing time to maneuver in residential areas or into or out of construction sites, flaggers would be stationed to slow or stop approaching vehicles to avoid conflicts with construction vehicles or equipment.

Parking. At construction locations with little or no on-street parking, the following mitigation measures would be implemented to reduce effects to less than significant.

- On-street parking for construction workers would be prohibited.
- Off-street parking would be identified and provided to the construction workers and their vehicles and trucks. If possible, parking would be close enough to walk to the site.

Bicycle Lane Use. During construction, signs would be placed at construction areas affecting Bizz Johnson Road to notify users of ongoing construction and limits in use. This temporary effect would be unavoidable.

4.4 EFFECTS ON NOISE

This section evaluates the effects of the alternatives on noise levels in the study area. These effects could be caused by short-term construction or maintenance activities along the levees in the study area. However, current maintenance activities would continue after construction so no new or additional noise would be generated during routine inspection or repair. Estimated noise levels from construction equipment were derived from analytical noise modeling techniques which generally make use of source-specific data including average levels of activity, hours of operation, seasonal fluctuations, and average levels of noise from source operations. Analytical methods have been developed for many environmental noise sources including roadways, railroad line operations, railroad yard operations, industrial plants, and aircraft and airport operations. The analytical methods used to prepare the data presented in this report closely follow recommendations made by the State Office of Noise Control and were supplemented where appropriate by source-specific noise-level data to account for local conditions.

The significance of a particular noise effect should be based on comparisons with applicable State and local noise-level standards and recognized public health criteria. For example, an increase in noise levels would be considered to be significant if the noise levels exceeded the average hourly noise levels described in the Yuba County General Plan.

The General Plan cites the California Office of Noise Control recommendation of 60 dB L_{dn} as the acceptable exterior noise level for residential units. Short-term construction-generated noise is normally exempt from these noise standards provided that the hours of operation fall within the days and times specified by the County.

To minimize noise effects, the Federal and State occupational (work place) noise level standard of 85 dBA (29 Code of Federal Regulations (CFR) 1910.5 and California Code of Regulations, Title 8, Group 15, respectively) was considered. Whenever employee noise exposure equals or exceeds 85 dBA on an 8-hour time weighted average sound level, Federal and State regulations require that hearing protection measures be implemented. Although this standard only applies to construction workers and not the general public, the standard can be used to compare potential noise effects at the nearest receptor. However, construction

noise would be intermittent and short term at each site so receptors would not be continuously exposed to noise levels at or above 85 dBA for a long time.

4.4.1 Alternative 1

The no-action alternative assumes that there would be no Federal participation in flood control improvements in the area. Development would continue according to the city and county general plans. The types of noise sources and sensitive receptors would be the same as existing conditions although the number of sources and receptors would likely increase due to any future growth. Since this alternative would involve no construction and maintenance practices would not change, the alternative would have no significant effects on noise in the study area.

4.4.2 Alternative 2

Adverse effects are identified by comparing estimated project noise levels to applicable noise standards.

Reach 1 - Yuba River/Feather River

The main land uses adjacent to the levees in reach 1 are open space, agriculture, or industrial with limited residential areas. Recommended ambient allowable noise level objectives from the General Plan for these land uses range from 50 dB to 70 dB. Construction in reach 1 would likely take 6 months and would take place between 7:00 a.m. and 5:00 p.m. on weekdays and 8:00 a.m. and 5 p.m. on weekends.

Levee raising, modifying and installing slurry walls, and berms and drains would use heavy equipment such as cranes, loaders, bulldozers, scrapers, and dump trucks. Operation of this equipment would generate noise levels between 76 and 91 dBA. The nearest receptor averages 50 to 100 feet from the noise-generating equipment. Since noise levels diminish with distance, the noise levels for these construction activities would be reduced the farther the receptor is located from the noise source.

Although city and county ordinances normally exempt short-term construction noise from standards, temporary increases in noise levels could occur at some residences close to the construction sites. Such conditions could result in "unacceptable" 24-hour average noise levels for a few days. In some locations, noise levels could exceed 85 dBA. These levels would be a particular concern at residences close to the construction site. Although construction noise would be

only temporary, individuals could experience brief periods of highly intrusive noise. This would be a short-term significant effect.

Reach 2 - Feather River

In reach 2, construction would take about 3 months, and noise levels would be similar to reach 1. However, there are no sensitive receptors in reach 2. The land adjacent to the construction site is used for agriculture, and the temporary increase in noise would not likely cause a significant adverse effect.

Reach 3 - Marysville Ring Levee

In reach 3, noise levels would also be similar to reach 1. However, in reach 3 the levees surround the city of Marysville where homes, businesses, and public facilities would be exposed to increased noise levels during construction. Construction is expected to take 6 months in this reach. During that time, residents, businesses, and people using the park facilities at Riverfront Park would be exposed to increases in noise. This would be a short-term significant effect.

4.4.3 Alternative 3

Reach 1 - Yuba River/Feather River

In reach 1, the construction area associated with Alternative 3 would be slightly less than Alternative 2. Alternative 3 has less levee improvement work than Alternative 2 because the levels of flood protection vary, 1 in 200 annual event for Alternative 3 and 1 in 250 annual event for Alternative 2. The levee improvements in reach 1 for Alternative 3 would be similar to Alternative 2. However, the heights of levee raising and berm work would be less; the depth of the slurry walls would be less; and some of the work sites would vary slightly. The construction schedule and equipment would be the same as described for Alternative 2. These differences are not expected to change the noise effects significantly from Alternative 2.

Reach 2 - Feather River

In reach 2, the levee improvements, construction sites, equipment, and schedule would be the same as Alternative 2. The level of flood protection provided by both alternatives would be the same. Therefore, the temporary increase in noise would not likely cause a significant adverse effect.

Reach 3 - Marysville Ring Levee

In reach 3, the levee improvements, construction sites, construction equipment, and schedule would be the same as described for Alternative 2. The effects on noise are expected to be the same as Alternative 2.

4.4.4 Mitigation

The construction activities in Alternatives 2 and 3 would affect (increase) noise levels in all three reaches. However, since there are no sensitive receptors in reach 2, no mitigation would be required in that reach. The effects in reaches 1 and 3 would only be short term. However, to minimize disruption to sensitive receptors, several mitigation measures would be implemented to reduce the effects of construction noise. Since the effects of the two alternatives would be the same, these mitigation measures would apply to Alternatives 2 and 3.

- Construction equipment would be outfitted and maintained with noise-reduction devices such as mufflers to minimize construction noise. All internal combustion engines would be operated with exhaust and intake silencers. Wherever possible, noise-generating construction equipment would be shielded from nearby residences, businesses, and public facilities by noise-attenuating buffers such as structures or truck trailers.

- To minimize noise effects on nearby residents, workers, and the general public during noise-sensitive periods, construction within 500 feet of existing residences, businesses, and public facilities would be limited to between the hours of 7:00 a.m. and 5:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on weekends.

- Prior to construction at each site near residences, business, or public facilities, the city or county would provide written notification to potentially affected residents, workers, and the general public identifying the type, duration, and frequency of construction activities. Notification materials would also identify a mechanism for residents to register complaints with the city or county if construction noise levels are overly intrusive or construction occurs outside the required hours. The city or county would take corrective action.

- Use of noise-reduction devices on construction equipment would reduce noise by an average of 5 to 10 dBA at 50 feet as shown on Table 4-1. Construction would be limited to specific hours. The 50-foot distance reflects the distance at which estimated noise levels would be about 75 dBA. This noise level is generally considered the minimum which is "clearly

unacceptable" for land use compatibility and planning. Mitigation would be consistent with International Standards Organization recommendation R-1996 by providing a mechanism for affect individuals to provide input or to seek corrective action is construction noise levels are overly intrusive.

Table 4-1. Construction Equipment Noise Levels Before and After Noise Control

Equipment Type	Noise Level at 50 feet (dBA)	
	Without Noise Control	With Feasible Noise Control
Earthmoving		
Front Loaders	79	75
Backhoes	85	75
Dozers	80	75
Tractors	80	75
Scrapers	88	80
Graders	85	75
Trucks	91	75
Pavers	89	80
Materials Handling		
Concrete Pumps	82	75
Cranes	83	75
Stationary		
Pumps	76	75
Generators	78	75
Compressors	81	75
Other		
Saws	78	75
Vibrators	76	75

Source: Bolt, Beranek, and Newman, Inc., 1971.

4.5 EFFECTS ON AIR QUALITY

According to Appendix G of the CEQA Guidelines, a project will normally have a significant air quality effect on the environment if it will violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations.

Draft significance criteria developed by the FRAQMD and conformity thresholds established by the EPA were used to determine the significance of project-related air quality effects. Project-related emissions were considered significant if emissions exceeded the FRAQMD's thresholds of (1) 25 pounds per day (lb/day) of ROG or NO_x or (2) 80 lb/day of PM_{10} (Shirhall pers comm, 1997).

In addition, project-related annual emissions were considered significant if emissions exceeded the EPA's general conformity thresholds. Those conformity thresholds are based on the *de minimis* thresholds included in the EPA's general conformity guidance regulation for the FRAQMD (40 CFR 51 and 93). The threshold levels equal 100 tons per year for the ozone precursors ROG or NO_x. Conformity thresholds do not apply for other pollutants (for example, PM_{10}, carbon monoxide (CO), and sulfur oxides) because the FRAQMD is classified as a Federal attainment area for those pollutants.

Emissions associated with each project alternative would be primarily construction related. Emissions include exhaust from construction equipment, fugitive dust generated by a variety of construction activities, exhaust from construction worker trips to and from sites, and exhaust from haul trips to and from the borrow/disposal site. Emissions from each of these activities were estimated as follows.

The first step involved estimating exhaust emissions related to off-road construction equipment. An inventory of off-road construction equipment was compiled. For each type of equipment, the Corps estimated daily and annual hours of operation and fuel use. That information was then multiplied by exhaust emission factors developed by the EPA (1985) and the South Coast Air Quality Management District (1993).

The second step involved estimating fugitive dust emissions associated with construction activities. Fugitive dust emissions would be generated at the construction areas, staging areas, and borrow/disposal site. The acreage for each of these areas was estimated and then multiplied by fugitive dust emission factors to obtain fugitive PM_{10} dust emissions. The fugitive dust emission factors were developed by the Midwest Research Institute for the South Coast Air Quality

Management District and the California Air Resources Board (Midwest Research Institute, 1996).

The third step involved estimating on-road vehicle emissions, including both borrow/disposal site haul trips and employee vehicle trips. Borrow/disposal site haul trip emissions were estimated by multiplying estimates of on-road equipment fuel use by fuel combustion emission factors developed by the EPA. Employee vehicle trip emissions were estimated by multiplying employee trips by the average number of miles per trip by the appropriate emission factor. The employee vehicle emission factors were based on California Air Resources Board's EMFAC7G computer model.

In the fourth step, emissions calculated for each activity were summed. Project-related emissions were compared to the FRAQMD's significance criteria and the *de minimis* conformity thresholds to determine the significance of the effects. The results of this comparison are described below for each project alternative.

4.5.1 Alternative 1

Under the no-project alternative, no construction activities would occur, and no emissions would be generated. Air quality in the study area would continue to be affected by local emissions and regional climatic conditions. However, air quality is expected to improve in the future as stricter ozone precursor and particulate matter standards are implemented by the California Air Resources Board and the FRAQMD.

4.5.2 Alternative 2

Alternative 2 is not expected to have any long-term effects on air quality. Operation (including inspection and maintenance) of this alternative is expected to be similar to operation of the existing flood control works. However, construction would result in direct, short-term effects on air quality. Two types of short-term emissions would occur: (1) combustion emissions and (2) dust emissions. Table 4-2 summarizes the estimated emissions (in lb/day and tons per year) for each of the 2 years of project construction. Work on reaches 1 and 2 would be conducted during the first year of the project, whereas work on reach 3 would be conducted during the second year.

Combustion emissions would result from the use of construction equipment, truck haul trips to and from the borrow/disposal site, and worker vehicle trips to and from the construction sites. Exhaust from these sources would contain ROG, CO, NO_x, and PM_{10}. Exhaust emissions would vary depending on the type of

equipment, the duration of use, and the number of construction worker and haul trips to and from the construction sites.

Table 4-2 shows that the short-term construction-related emissions of NO_x and PM_{10} would exceed the lb/day significance thresholds established by the FRAQMD in years 1 and 2, whereas ROG emissions would exceed the threshold only in year 2. Implementing the mitigation measures identified in Section 4.5.4 would reduce these effects, but not to a less-than-significant level. However, even though emissions would exceed the FRAQMD thresholds, they represent short-term, temporary construction emissions.

Table 4-2 also shows that emissions of ROG and NO_x would each be less than the 100 tons per year *de minimis* thresholds established by the EPA for conformity analyses. Consequently, the proposed action does not require an in-depth conformity analysis to evaluate ambient air quality concentrations and instead is presumed to conform to the region's ozone state implementation plan. Thus, the Corps has determined that the proposed action is exempt from the conformity rule.

4.5.3 Alternative 3

The air quality effects of Alternative 3 are expected to be similar to but slightly less than those of Alternative 2. Emissions would be slightly lower because Alternative 3, in certain reaches, requires lower berms and levees than Alternative 2. However, when the emissions are considered on a lb/day basis, the effect of Alternative 3 would be significant and unavoidable even with the mitigation measures in Section 4.5.4.

Annual emissions associated with Alternative 3 would be similar to but slightly less than those associated with Alternative 2 and would be less than the general conformity thresholds.

4.5.4 Mitigation Measures

The following mitigation measures would be used to reduce the construction-related air quality effects of Alternatives 2 and 3:

- Prepare and implement a dust suppression plan.
- Incorporate NO_x mitigation measures into construction plans and specifications.

Table 4-2. Estimated Combustion and Dust Emissions of the Project

	Emissions (pounds/day)[1]				Emissions (tons/year)[2]			
	ROG	NO_x	PM_{10}	CO	ROG	NO_x	PM_{10}	CO
YEAR 1								
Combustion Emissions								
Off-Road Construction Vehicles[3]	17.6	256.5	9.2	55.8	1.2	16.9	0.6	3.7
On-Road Construction Vehicles[3]	4.8	54.8	2.0	42.2	.3	3.6	0.1	2.8
Construction Worker Vehicle Trips[4]	1.8	20.7	2.2	.1	.3	2.4	.3	<0.1
Subtotal	24.2	332.0	13.4	98.1	1.8	22.9	1.0	6.6
Fugitive Dust Emissions[5]	-	-	217.0	-	-	-	19.8	-
Total - Year 1 (Unmitigated)	**24.2**	**332**	**230.4**	**98.1**	**1.8**	**22.9**	**20.8**	**6.6**
Total - Year 1 (Mitigated)[6]	**23.0**	**315.4**	**127.9**	**93.2**	**1.7**	**21.8**	**10.9**	**7.1**
YEAR 2								
Combustion Emissions								
Off-Road Construction Vehicles[3]	30.2	441.6	15.8	96.0	2.0	29.1	1.0	6.3
On-Road Construction Vehicles[3]	9.2	115.2	4.1	63.1	0.6	7.6	0.3	4.2
Construction Worker Vehicle Trips[4]	2.3	2.8	0.1	26.9	0.2	0.2	<0.1	1.8
Subtotal	41.7	559.6	20.0	186.0	2.8	36.9	1.4	12.3
Fugitive Dust Emissions[5]	-	-	151.9	-	-	-	13.9	-
Total - Year 2 (Unmitigated)	**41.7**	**559.6**	**171.9**	**186.0**	**2.8**	**36.9**	**15.3**	**12.3**
Total - Year 2 (Mitigated)[6]	**39.6**	**531.6**	**95.0**	**176.7**	**2.7**	**35.1**	**8.3**	**11.7**
Emission Thresholds	**25.0**	**25.0**	**80.0**	.[7]	**100.0**	**100.0**	.[8]	.[8]

[1]Emissions in pounds per day are included for comparison with FRAQMD emissions significance thresholds in bottom row.

[2]Emissions in tons per year are included for comparison with EPA's emission *(de minimis)* thresholds in bottom row.

[3]Off-road and on-road construction vehicle emissions based on vehicle information itemized by reach, construction activity, and construction equipment type.

[4]Construction worker vehicle vehicle trip emissions based on estimates of the number of construction vehicles and an average commute trip of 40 miles per day.

[5]Fugitive PM_{10} dust emissions assume that reaches 1 and 3 would require 6 months of construction and that reach 2 would require 3 months of construction. Uncontrolled fugitive dust emissions assume that one-third of the total area under construction, including the borrow/disposal site, would be actively disturbed at any given time. Fugitive dust emissions are based on PM_{10} fugitive dust emission rates developed for the California Air Resources Board (Midwest Research Institute, 1996).

[6] Mitigated fugitive dust emissions are based on 50 percent emission control (EPA, 1995). Mitigated combustion emissions are based on 95 percent control using emission control efficiencies specified by the Sacramento Metropolitan Air Quality Management District.

[7]The FRAQMD does not have a designated emission threshold for CO.

[8]No applicable tons per year emission thresholds exists for CO or PM_{10} because the project is in an area that meets the Federal CO and PM_{10} ambient air quality standards.

Prepare and Implement a Dust Suppression Plan

The Corps would prepare a dust suppression plan and submit it to the FRAQMD for review before initiating construction activities. The plan would include as many of the following mitigation measures as are applicable to each project site:

- Cover, enclose, or water active storage piles at least twice daily at the project site, staging areas, and borrow/disposal site.
- Cover inactive storage piles.
- Pave all haul roads.
- Cover securely or maintain at least 2 feet of freeboard on all haul trucks when transporting material.
- Water all active construction sites at least twice daily. Frequency should be based on the type of operation, soil, and wind exposure.
- Prohibit all grading activities during periods of high wind (greater than 30 miles per hour measured as instantaneous gusts).
- Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least 4 consecutive days).
- Apply nontoxic binders (for example, latex acrylic copolymer) to exposed areas after cut-and-fill operations and hydroseed area.
- Plant vegetative ground cover in disturbed areas as soon as possible.
- Sweep streets if visible soil material is carried onto adjacent public roads.
- Post a publicly visible sign at the project site to specify the telephone number and person to contact regarding complaints. This person would be responsible for responding to complaints and taking corrective action within 48 hours.

Incorporate NOx Mitigation Measures into Construction Plans

The Corps would ensure that its construction contractors limit NO_x emissions by implementing the following measures:

- Use Caterpillar prechamber diesel engines (or equivalent) together with proper maintenance and operation.
- Use electric equipment, where feasible.
- Maintain equipment in tune with manufacturers' specifications.
- Use gasoline-powered equipment installed with catalytic converters.
- Substitute gasoline-powered for diesel-powered equipment, where feasible.
- Use compressed natural gas or onsite propane mobile equipment instead of diesel-powered equipment, where feasible.

If these mitigation measures are implemented, dust-related PM_{10} emissions would be reduced by at least 50 percent, and NO_x emissions would be reduced by 5 percent. Even so, the project would still exceed the significance thresholds established by the FRAQMD. However, those exceedances would occur only during the 2-year construction period.

4.6 EFFECTS ON VEGETATION AND WILDLIFE

This section evaluates the effects of the project alternatives on vegetation and wildlife resources in the study area. Project effects on these resources in the three reaches include both temporary and permanent effects. The temporary effects would result from slurry wall installation and modification and levee raising less than 0.5 foot. Permanent effects would be the result of the increased width of the levee associated with levee raising above 0.5 foot and berm and drain construction and modification. Effects are summarized in Table 4-3.

Project effects for the study area were analyzed with the FWS during coordination under the Federal Fish and Wildlife Coordination Act. A Habitat Evaluation Procedures (HEP) analysis was conducted for the entire study area to determine project effects on fish and wildlife resources. This section includes a summary of the HEP analysis. A detailed discussion of the HEP analysis is included in the draft CAR in Appendix A.

The significance of project effects on biological resources was evaluated by using the following significance criteria. Corps policy guidance contained in Engineering Regulation 1105-2-100 establishes the following significance criteria:

- Significance based on institutional recognition means that the importance of the effect is acknowledged in the laws, adopted plans, and other policy statements of public agencies and private groups. Institutional recognition of an effect is often explicit in the form of specific criteria for determining whether an effect is significant.

- Significance based on public recognition means that some segment of the general public recognizes the importance of the effect. Public recognition may take the form of controversy, support, conflict, or opposition; it may be expressed formally (as in official letters) or informally. Environmentally related customs and traditions should also be considered in determining sources of public recognition.

- Significance based on technical recognition means that the importance of an effect is based on technical or scientific criteria related to critical resource characteristics.

In addition, significance thresholds were identified from the CEQA Guidelines and local and regional plans and ordinances for the environmental issues analyzed in this report. Significance thresholds were based on the following:

- Substantially affect a rare or endangered species (Appendix G (c)).

- Interfere substantially with movement of any resident or migratory fish or wildlife species (Appendix G (d)).

- Substantially diminish the habitat for fish, wildlife, or plants (Appendix G (t)).

- Involve the use, production, or disposal of materials which pose a hazard to animal or plant populations in the affected area (Appendix G (v)).

- Adversely affect a plant or animal taxa considered locally important.

4.6.1 Alternative 1

The no-action alternative assumes that the Federal Government would not participate in a flood control project in the Yuba River Basin study area. However, vegetation and wildlife resources may change in the future without the project.

Table 4-3. Project Alternatives and Acreages Affected

Study Area Location (Levee mile)	Alternatives and Acreages Affected						
	Alternative 1 (No Action)	Alternative 2 (NED)			Alternative 3		
Reach 1-Yuba River		Temporary	Permanent	Total	Temporary	Permanent	Total
0.00-0.28	0	1.05 acres	0.35 acre	1.4 acres	0	0	0
0.28-0.35	No work	No work	No work	No work	No work	No work	No work
0.35-0.92	0	1.96 acres	2.28 acre	4.24 acres	2.07 acres	2.41 acres	4.48 acres
0.92-1.79	0				0	0	0
0.92-1.23	0	1.24 acres	0.41 acre	1.65 acres			
1.23-1.79	0	0	0	0			
1.77-2.18	0	1.48 acres	0.99 acre	2.47 acres	1.49 acres	1.27 acres	2.76 acres
2.18-2.22	No work	No work	No work	No work	No work	No work	No work
2.22-2.97	0	2.71 acres	1.44 acres	4.15 acres	0	0	0
2.92-3.86	0				3.41 acres	2.68 acres	6.09 acres
2.92-3.59	0	2.33 acres	2.33 acres	4.66 acres			
3.59-3.86	0	0.98 acre	0.98 acre	1.96 acres			
3.86-4.00	No work	No work	No work	No work	No work	No work	No work
4.00-4.26	No work	0.95 acres	0.63 acre	1.58 acres	No work	No work	No work
4.26-6.13	No work	14.69 acres	5.32 acre	20.01 acres	13.6 acres	4.6 acres	18.2 acres
Reach 1-Feather River							
20.04-23.08	0				11.05 acres	7.73 acres	18.78 acres
20.00-20.49	0	1.78 acres	0.59 acres	2.37 acres			
20.49-23.64	0	11.4 acres	5.72 acres	17.12 acres			
23.08-25.02	0				0	0	0
23.64-25.12	0	5.38 acres	1.79 acres	7.17 acres			
25.12-26.07	0	0	0	0			
Reach 2-Feather River							
15.86-16.49	0	2.3 acres	1.45 acres	3.75 acres	2.3 acres	1.45 acres	3.75 acres
16-47-16.99	0	0	0	0	0	0	0
Reach 3-Yuba River							
0.00-1.00	0	3.64 acres	2.6 acres	6.24 acres	3.64 acres	2.6 acres	6.24 acres
Reach 3-Feather River/Jack Slough	0						
0.00-3.25	0	11.82 acres	8.8 acres	20.62 acres	11.82 acres	8.8 acres	20.62 acres

Table 4-3. Project Alternatives and Acreages Affected - Continued

	Alternatives and Acreages Affected						
Reach 3-Marysville Ring levee							
25.81-27.08	0	4.6 acres	3.4 acres	8.0 acres	4.6 acres	3.4 acres	8.0 acres
Totals	0	68.31 acres	39.08 acres	107.39 acres	53.98 acres	34.94 acres	88.92 acres

Reach 1 - Yuba/Feather River

Without the project, vegetation and wildlife resources are not expected to change significantly from existing conditions. The grassland vegetation on the levees is expected to be maintained by the levee districts according to current maintenance procedures. Therefore, the value of the levee slopes to wildlife is not likely to improve in the future. No significant change in woody or herbaceous vegetation is expected on lands within the project levees. Annual grassland and agricultural lands on the landside of the levee, beyond the levee toe, is not expected to change significantly, although some conversion of annual grassland to agriculture or urban development may occur. Since only minimal changes are expected in vegetation, wildlife populations in the study area are expected to continue with normal year-to-year fluctuations of individual species.

Without the project, construction associated with Phase II of the System Evaluation would be completed. Levee slopes in reach 1 that would be disturbed during construction would be reseeded, and appropriate mitigation for project effects would be completed.

Reach 2 - Feather River

Without the project, vegetation and wildlife resources in reach 2 are not expected to change significantly from existing conditions. The levees would continue to be maintained, and no significant changes to vegetation within the levees is expected. Agricultural land uses on the landside of the levee are expected to continue in the future. The borrow/disposal site is a fallow agricultural field; therefore, there would be no adverse effects to vegetation or wildlife at this site. With minimal changes to vegetation, wildlife populations are expected to remain the same with year-to-year fluctuations of individual species.

Without the project, construction associated with Phase II would be completed. Levee slopes in reach 2 that would be disturbed during construction would be reseeded, and appropriate mitigation for project effects would be completed.

Reach 3 - Marysville Ring Levee

Without the project, vegetation and wildlife resources in reach 3 are not expected to change significantly from existing conditions. The levees would continue to be maintained, and no significant changes to vegetation on the waterside of the levees are expected. The DFG manages many of the areas on the waterside of the levees for the city of Marysville. This management is not expected to change in the future. Additionally, the Riverfront Park facilities are not

expected to change without the project. On the landside of the levees, the urban land uses would not change without the project. No significant new development is expected within the levees around Marysville because the city area is fully urbanized.

Construction associated with the Phase II would be completed. Any disturbed levee slopes would be reseeded, and appropriate mitigation would be completed.

4.6.2 Alternative 2

Project effects of the NED plan would occur due to constructing and modifying berms and drains, levee raising, and installing and modifying slurry walls.

Reach 1 - Yuba/Feather River

Project effects to vegetation and wildlife resources associated with levee modifications would be both temporary and permanent. The annual grassland and agricultural habitat along the levee slopes, landside construction easements, and staging area would be cleared prior to construction, and temporary loss or disturbance of vegetation would occur from various construction activities and equipment. Slurry wall installation and modification effects would be confined to the top of the levees and levee slopes and would be temporary. Levee raising would be constructed from the landside of the levee. If the levee is raised less than 0.5 foot, the construction would take place from the existing levee embankment, and no additional lands would be needed for construction. Temporary effects to grassland habitat would be limited to the top of the levee and levee slope. If the levee is raised more than 0.5 foot, a 10-foot permanent easement and a 30-foot temporary easement from the current levee toe would be needed. Levee berms and drain construction and modification would be constructed from the landside of the levee and would need a 10-foot permanent easement and a 30-foot construction easement from the new levee toe. About 32.35 acres of grassland and agricultural land would be temporarily affected in reach 1. These effects would be considered short-term and insignificant. Riparian shrub vegetation and one elderberry shrub would be avoided during construction between LM's 4.26 and 6.13 on the south levee of the Yuba River.

After construction, the lands within the temporary construction easement would return to its pre-project use, either agriculture or annual grassland. The lands within the permanent easement, levee slopes, and maintenance area would be reseeded and would remain in annual grassland. The increased footprint of the levee due to levee raising and berm construction and modification would result in the permanent loss of 0.30 acre of woodland habitat. Due to the importance of

woodland vegetation on a local and regional basis, this permanent effect would be considered significant.

Wildlife species that inhabit the construction sites or nearby areas would be temporarily disturbed or displaced and would likely move to adjacent areas of similar habitat. Generally, the areas surrounding the levees support similar habitat and would provide resident species with alternative habitat. However, the permanent loss of woodland habitat, although small, would further reduce this scarce habitat to resident species. These project effects would likely be significant to those species using the habitat.

Reach 2 - Feather River

In reach 2, project construction associated with alternative 2 would consist of modifying berms and drains and increasing slurry wall depths. Temporary effects to grassland and agricultural habitats would be disturbance of 2.3 acres. Temporary and permanent easements would be the same as reach 1. Permanent effects would include the loss of 1.45 acres of grassland and agricultural habitat. Land within the temporary easement and the staging area would be returned to its pre-construction use while lands within the permanent easement would be reseeded and would remain in annual grassland. These effects would be considered insignificant. There would be no permanent effects to woodlands in this reach.

Wildlife species that inhabit the construction sites or nearby areas would be temporarily disturbed or displaced and would likely move to adjacent areas of similar habitat. Generally, the areas surrounding the levees support similar habitat and would provide resident species with alternative habitat.

Reach 3 - Marysville Ring Levee

In reach 3, project construction would consist of waterside slurry walls. There are two types of slurry wall design in this reach: (1) the slurry wall is installed beyond the existing toe of the levee and (2) the slurry wall is installed under the levee slope. The construction easements would include a 10-foot permanent and a 30-foot construction easement beyond the toe of the new berm and a 30-foot construction easement from the existing levee toe. The temporary effects would include disturbance of 20.06 acres of grassland and agricultural habitat, and permanent effects would include the loss of 14.8 acres. Of the permanently affected acreage, 1.93 acres would be woodland habitat. The temporarily affected areas would return to their pre-project use after construction. The permanent easement and levee slopes would be reseeded and would remain in annual grassland. These effects would not be significant. The permanent loss of

woodland habitat would be considered significant due to its scarcity and importance on a local and regional basis.

Wildlife species that inhabit the construction sites or nearby areas would be temporarily disturbed or displaced and would likely move to adjacent areas of similar habitat. Generally, the areas surrounding the levees support similar habitat and would provide resident species with alternate habitat. However, the permanent loss of woodland habitat, although small, would further reduce this scarce habitat to resident species. These project effects would likely be significant to those species using the habitat.

To this point, habitat loss due to alternative 2 has been quantified in terms of lost acres. Quantifying habitat loss in terms of lost acres does not reflect the varying quality of habitats to the species that inhabit them. There are specific components of habitats that make them more valuable to wildlife than others and therefore cannot be quantified in terms of lost acres. The quality of habitat for wildlife was measured using a HEP analysis. This analysis combines the quality and quantity of habitat to quantify project effects and mitigation requirements. The HEP analysis measures habitat value at baseline or current conditions and compares that value with the estimated habitat value at various points in time throughout the project life (50 years). In a similar manner, compensation or mitigation needs for the project can be determined.

The HEP analysis is based on the assumption that the value of habitat to a selected species or group of species can be described in a model(s) which uses variables that represent habitat suitability for wildlife. The models produce a Habitat Suitability Index, which is multiplied by the area of available habitat to obtain habitat units (HU's). The HU's and Average Annual Habitat Units (AAHU's) over the life of the project are then used in the comparisons described in the previous paragraph. The AAHU's lost with this alternative reflect the permanent loss of habitat as a result of levee raising and berm and drain construction and modification. The results of the HEP analysis for Alternative 2 would be the same as Alternative 3 because the permanent effects are the same. Therefore, there would be a loss of 1.54 AAHU's with either alternative.

Project effects to upland areas, annual grassland, and agriculture were not considered significant losses and were not included in the HEP analysis. These areas would likely be returned to their pre-project conditions after construction is completed. Additionally, potential habitat for special status species was not included in the HEP analysis. Effects and mitigation for these species are determined during coordination under the Endangered Species Act and are not included in the HEP analysis.

4.6.3 Alternative 3

Project effects of this alternative would occur due to constructing and modifying berms and drains, levee raising, and installing and modifying slurry walls.

Reach 1 - Yuba/Feather River

With Alternative 3, there would be temporary and permanent effects to vegetation and wildlife resources similar to Alternative 2. The temporary effects would be less, that is, 18.02 acres, while the permanent effects to woodland habitat would be the same as Alternative 2. The construction area associated with Alternative 3 would be slightly less than that described for Alternative 2. Alternative 3 has less levee improvement work than Alternative 2 because the levels of flood protection vary, 1 in 200 annual event for Alternative 3 and 1 in 250 annual event for Alternative 2. The levee improvements in reach 1 for Alternative 3 would be similar to Alternative 2; the heights of levee raising and berm work would be less; the depth of the slurry walls be less; and some of the work sites vary slightly. However, the easement areas, construction schedule, and equipment would remain the same. Therefore, project effects on vegetation and wildlife resources are not expected to change significantly from Alternative 2.

Reach 2 - Feather River

In reach 2, the levee improvements, construction sites, equipment, and schedule would be the same as Alternative 2. The level of flood protection provided by both alternatives would be the same. The construction easements and project effects would be the same as Alternative 2.

Reach 3 - Marysville Ring Levee

In reach 3, the levee improvements, construction sites, construction equipment, and schedule would be the same as Alternative 2. However, the depths of the slurry walls would be less with this alternative because the level of flood protection provided is for a 1 in 200 annual event compared to a 1 in 300 annual event with Alternative 2. The easement areas and project effects on vegetation and wildlife resources would be the same as Alternative 2.

4.6.4 Mitigation

Mitigation was developed in coordination with FWS and is based on recommendations from the FWS's draft CAR. Under the Fish and Wildlife Coordination Act, the FWS is authorized to conduct surveys and investigations "for the purpose of determining the possible damage to wildlife resources and for the

purpose of determining means and measures that should be adopted (by the Corps) to prevent the loss of or damage to such wildlife resources." The reports and recommendations of the FWS must be made an integral part of any Corps report that seeks congressional or other Federal authority to construct a project. Potential mitigation measures are discussed below.

Mitigation for significant project effects result from the permanent loss of habitat as expressed in the HEP analysis. These effects would be mitigated by providing acreage and similar habitat to replace the lost values. The project effects to significant habitat for Alternative 2 are the same as Alternative 3. Therefore, the proposed mitigation would be the same for both alternatives.

Mitigation Sites

Potential mitigation sites were evaluated by the HEP team, and consideration was given to selecting a viable site close to the construction areas. The results of the HEP analysis indicated that a small amount of mitigation was needed, that is, 2.98 acres of woodland habitat. One option, purchasing 2.98 acres of available land and creating woodland habitat, was considered. The most likely type of land to be purchased would be agriculture (orchard) or grassland which would then be converted to woodland habitat. Due to the small size of the mitigation needed, however, it would be difficult to plan and sustain a viable mitigation site. Generally, species inhabit areas much larger than 2.98 acres. The costs for developing habitat on such a small site were also considered. The costs would likely be high and the potential gains small. If developed for mitigation, the site would be a small and fragmented habitat that would not likely attract and sustain wildlife species and would not successfully mitigate for project effects. Therefore, a second option was considered.

The proposed work for the Yuba River Basin Investigation largely "piggybacks" work already planned or being constructed as part of Phase II of the System Evaluation. A component of the Phase II work was the development of a 78.5-acre compensation site to offset unavoidable effects of that project. The site was developed during the first year of project construction along the Feather River near the end of Country Club and Anderson Roads. Subsequently, however, the work proposed in the System Evaluation was reevaluated, and portions of the work originally planned in the Phase II project area were deleted from the project. The mitigation for this Yuba River basin project could use the available compensation "credits" at this site to fulfill the 2.98-acre mitigation requirement.

The available compensation "credits" after the work was deleted from Phase II consisted of 54.04 acres. Of the available 54.04 acres, 4.0 acres were lost to 1997 flood damage and will not be replaced; 5.0 acres were used for

mitigation for 1997 flood damage repair work in Reclamation District 1660/70; and 3.0 acres were used for mitigation for 1997 flood damage repair work in Reclamation District 784. Therefore, 42.04 acres of "credit" remained at the mitigation site. This Yuba River basin project proposes to use 2.98 acres of "credit." This second option was considered because of the lower costs of using established mitigation "credits" at an existing site. Additionally, project effects would be compensated on a larger, more biologically meaningful parcel, ensuring the success of project mitigation. Both FWS and the non-Federal sponsor support this second option. The project mitigation is displayed in Table 4-4.

The mitigation for flood control work deleted from Phase II was included to compensate for adverse effects to the Federally listed valley elderberry longhorn beetle habitat in reach 1 from LM 3.8 to LM 6.1. However, subsequent levee maintenance work in Reclamation District 784 has eliminated all of this beetle habitat. Had this habitat not been removed by Reclamation District 784, mitigation for the levee improvements as part of the Yuba River Basin Investigation would have been needed. As a result, any remaining "credits" at the mitigation site for the Phase II project will not be available for future mitigation.

Based on the results of the HEP analysis, a qualitative evaluation of the costs and the habitat value gained from using existing "credits" at the existing mitigation site was compared against the costs and potential habitat value gained from purchasing land and creating mitigation on a parcel in the study area. The evaluation indicated that using existing "credits" at the mitigation site would be the most cost effective way to provide the habitat values needed for mitigation. Using existing "credits" at the mitigation site is more cost effective because the land is already owned by the Corps and the State and the area has been planted and is in its third year of monitoring. Guidance from Corps Headquarters Office indicates that in this situation, an incremental analysis is not needed.

Table 4-4. Project Mitigation

Habitat Type	Mitigation Location and Acres	Mitigation Measure
Woodland	Phase II mitigation site, 2.98 acres	Use existing mitigation credits for woodland habitat

4.7 EFFECTS ON SPECIAL STATUS SPECIES

Endangered and threatened species and other special status species may be adversely affected by the loss of habitat and disturbances associated with the project alternatives. Suitable habitat exists in the study area for several special status species including the giant garter snake, northwestern pond turtle, American peregrine falcon, bald eagle, Aleutian Canada goose, Swainson's hawk, tricolored blackbird, and valley elderberry longhorn beetle. Any project action which would affect the continued existence of an endangered or threatened species or a species of special concern is considered to be a significant effect.

4.7.1 Alternative 1

The no-action alternative assumes that the Federal Government would not participate in a flood control project in the study area. However, special status species may be affected in the future without the project.

Reach 1 - Yuba River/Feather River

Without the project, habitat along the levees and in the construction easement areas is not expected to change significantly from existing conditions. The rural and agricultural nature of the construction areas would not change. Any future development would occur away from the levees as described in the Yuba County General Plan. Habitats for special status species would continue to be affected by ongoing levee maintenance activities, human disturbance, and periodic flooding.

Reach 2 - Feather River

Without the project, habitats along the levees, construction easements, and adjacent orchards are not expected to change significantly from existing conditions. The rural and agricultural nature of the construction areas would not change. Future development would be avoided in the high value agricultural areas such as orchards, which are adjacent to the levees. Future development as described in the County General Plan would occur on the east side of Feather River Boulevard and not directly adjacent to the Yuba River levee. Habitats for special status species would continue to be affected by ongoing levee maintenance activities, human disturbance, and periodic flooding.

Reach 3 - Marysville Ring Levee

Without the project, habitats in reach 3 are not expected to change significantly from existing conditions. The vegetation on the waterside of the

levees would remain the same. There would be no development on the waterside of the levee because it is a floodway for Jack Slough and the Yuba and Feather Rivers. For the foreseeable future, the DFG would continue to manage several wildlife areas on the waterside of the levees. Habitats for special status species would continue to be affected by ongoing levee maintenance activities, human disturbance, and periodic flooding.

4.7.2 Alternative 2

Project effects to special status habitat would occur due to constructing and modifying berms and drains, levee raising, and installing and modifying slurry walls. There is no special species habitat at the borrow/disposal site in reach 2. This section contains information on potential effects to special status species that may be adversely affected by the project. Except for the giant garter snake, these special status species could be found in all three reaches. Snake habitat only occurs in reach 3.

Giant Garter Snake

Suitable habitat exists in the study area in reach 3 between LM 2.0 and LM 3.0 for the giant garter snake. There are rice fields and drainage ditches about 50 feet from the existing levee toe. However, waterside slurry wall work has been modified in this reach to avoid the irrigation ditches and rice fields. The slurry wall would be installed underneath the existing levee slope with a construction easement of 30 feet. All of the construction equipment and excavated material would remain within the construction easement. The levee in this reach could provide habitat for the snake during its dormant season. However, with appropriate avoidance measures, project construction is not expected to adversely affect the giant garter snake or its habitat.

Northwestern Pond Turtle

Suitable habitat for the turtle exists in the study area in reach 3 along Jack Slough and in slow-moving pools along the banks in the Feather and Yuba Rivers. In reach 3, project construction would take place on the waterside of the levee, but equipment and materials would be limited to the temporary and permanent easements which would avoid Jack Slough. The levee is far enough from the slough that the levee and staging areas would not be considered upland basking habitat. Therefore, no adverse effects to the turtle or its habitat are expected. In reaches 1 and 2, construction would be done on the landside or on top of the levee, avoiding any effects to the Yuba and Feather Rivers. The levees are set back far enough from the rivers that the levees would not be considered upland

basking habitat. Therefore, no adverse effects to the turtle or its habitat are expected.

American Peregrine Falcon

Suitable foraging habitat for the falcon occurs along the Feather and Yuba Rivers and in agricultural lands and rice fields. The foraging habitat is likely used by the falcon during the winter migration. Project construction would temporarily affect the foraging habitat when it occurs near construction sites or at staging areas. However, areas in temporary construction easements would likely return to their previous use after construction, and the effects to foraging habitat would be temporary. Permanent loss of foraging habitat is expected to be minor because most of the area converted to permanent easement would remain in annual grassland. Additionally, project construction would take place from April to November when the possibility that falcons would be migrating and stopping at the study area would be small. Therefore, no significant adverse effects to the falcon would be expected.

Bald Eagle

In the study area, suitable foraging habitat for the eagle occurs along the Feather and Yuba Rivers and in agricultural lands and rice fields. These areas are likely used by the eagle during the winter migration. Project construction would temporarily effect the foraging habitat when it occurs near construction sites and staging areas. However, areas in temporary construction easements would likely return to their previous use after construction, and the effects to foraging habitat would be temporary. Permanent loss of foraging habitat is expected to be minor because most of the area converted to permanent easement would remain in annual grassland. Additionally, project construction would take place from April to November when the possibility that eagles would be migrating and stopping at the study area would be small. Therefore, no significant adverse effects to the eagle would be expected.

Aleutian Canada Goose

In the study area, suitable habitat for the goose occurs in agricultural lands, small lakes, refuges, and flooded fields. These habitats would be used as winter habitat for the goose. Project construction would not adversely affect any small lakes, refuges, or flooded fields. Some agricultural lands near construction sites and staging areas would be temporarily affected due to project construction activities but would return to their previous use after construction. Permanent loss of foraging habitat is expected to be minor because most of the area converted to permanent easement would remain in annual grassland. Additionally, project

construction would take place from April to November when the possibility that geese would be wintering in the study area would be small. Therefore, no significant adverse effects to the goose would be expected.

Swainson's Hawk

Suitable habitat for the Swainson's hawk exists in all reaches of the study area. Surveys were conducted for the Swainson's hawk for the System Evaluation in 1994. The surveys included portions of reaches 1 and 2 and indicated that hawks were observed at various spots along the Yuba and Feather Rivers. Therefore, it is likely that hawks may occur and/or nest in the study area. There is also suitable foraging habitat in the grasslands and agricultural areas in reaches 1 and 2. Reach 3 has not been surveyed. However, potential habitat exists in the riparian areas near Jack Slough, and foraging habitat exists in the adjacent annual grassland and agricultural areas. Therefore, it is assumed that the Swainson's hawk would be adversely affected by project construction activities.

The DFG has determined that hawks greater than one-fourth mile away would not be adversely affected by construction disturbances. However, Swainson's hawks frequently change the location of their nest site from year to year. Therefore, preliminary mitigation/avoidance measures are discussed in Section 4.7.4, and the study area would be surveyed prior to construction to locate specific nest sites and identify specific mitigation/avoidance measures for nests that could be adversely affected.

Tricolored Blackbird

Near the study area, there have been numerous documented sightings of the tricolored blackbird (DFG, 1997). However, the sightings were about 5 to 10 miles from the project construction sites, between SR 70 and SR 65 near Best Slough. Suitable foraging habitat exists elsewhere in the study area, but construction activities are not expected to adversely affect this habitat. Some agricultural lands near construction sites and staging areas would be temporarily affected due to project construction activities but would return to their previous use after construction. Permanent loss of foraging habitat is expected to be minor because most of the area converted to permanent easement would remain in annual grassland. Therefore, no significant adverse effects to the tricolored blackbird are expected.

Valley Elderberry Longhorn Beetle

There are three elderberry shrubs within the construction right-of-way in reach 3 along the Yuba River near LM 1.0. These shrubs contain a total of 15

stems greater than 1 inch in diameter at ground level, and less than 50 percent of the stems have exit holes. These shrubs would have to be removed during construction. This would be a significant adverse effect.

Hartweg's Golden Sunburst

In 1990, there was a documented occurrence of the Hartweg's golden sunburst within the study area (DFG, 1997). However, this plant was found on the north bank of the Yuba River at the junction of the Yuba and Feather Rivers. Construction activities associated with this project would take place on the south levee of the Yuba River and are not expected to adversely affect this species. Therefore, no significant adverse effects to the Hartweg's golden sunburst are expected.

4.7.3 Alternative 3

Although the levee improvements for Alternative 3 would be slightly different than those described in Alternative 2 due to varying levels of flood protection, the construction methods and resulting effects and significance on special status species would be the same for both alternatives.

4.7.4 Mitigation

Implementation of any of the alternatives would likely have significant adverse effects on special status species. Proposed mitigation measures must be coordinated with FWS for Federally listed species and DFG for State-listed species. The mitigation plan must be consistent with recommendations contained in Biological Opinions from the FWS and DFG. The proposed mitigation measures have been developed using survey reports and mitigation recommendations, programmatic agreements between the Corps and the FWS or DFG, and mitigation guidelines published by FWS or DFG. Mitigation and avoidance measures are proposed for the giant garter snake, Swainson's hawk, and the valley elderberry longhorn beetle. Mitigation measures for these species are included in the biological assessment for consideration by FWS and DFG in preparation of their biological opinions. A draft of the biological assessment is included in Appendix C.

Giant Garter Snake

Potential adverse effects to the giant garter snake would be avoided by implementing the following measures:

- Construction activity would be confined within or near potential habitat to the period between May 1 and October 31.

- Prior to construction activities, a qualified biologist would instruct all construction personnel in worker awareness training to recognize garter snake and its habitat.

- Prior to construction activities, the site would be inspected by a qualified biologist who has the necessary collection permits and is approved by the Sacramento Field Office of the FWS to minimize and avoid the killing and harassing of giant garter snakes.

- Nearby habitat designated as environmentally sensitive to the snake would be flagged and avoided by all construction personnel.

- Movement of heavy equipment to and from the project site or borrow/disposal site would be confined to existing roadways to minimize habitat disturbance. Equipment would stay at least 30 feet from the banks of giant garter snake aquatic habitat.

- Any dewatered habitat would remain dry for at least 15 consecutive days prior to construction.

- If a giant garter snake is encountered during construction, activities would cease until capture and relocation have been completed by the FWS-approved biologist. Any incidental take would be reported to the FWS immediately by telephone at (916) 979-2725.

Swainson's Hawk

- Prior to construction, a hawk survey would be conducted by a qualified biologist in cooperation with DFG to determine whether Swainson's hawks are intending to nest within or adjacent to the project construction sites. The survey would include the areas within one-half mile radius of the project sites, borrow/disposal site, and haul routes. If a nest is located within the one-half mile radius, DFG would be consulted to determine if the proposed work activity would disturb the nest.

- If nests are found, no project construction would take place between March 1 and May 1, when the Swainson's hawks are returning from their winter migration and establishing nest territories.

- A worker awareness program for construction workers would be conducted by a qualified biologist before the start of construction. The program would provide workers with information on their responsibilities with regard to sensitive biological resources.

- Any potential Swainson's hawk nest trees (trees with a height of over 20 feet and diameter at breast height greater than 6 inches) planned for removal would be removed between October 1 and February 28 (outside the hawk nesting season). Trees to be removed would be replaced by native tree species at a 2:1 ratio. For every five trees that are removed, an artificial hawk perch would be installed in the vicinity of the tree replacements. The perches would be maintained until the replacement trees are established to a height and strength to support large birds.

- Replacement habitat to compensate for foraging habitat losses could be provided either by replacing lost habitat on a 1:1 basis per acre lost or paying $3,000 per lost acre to attain mitigation goals for the Swainson's hawk. This cost has been determined by DFG to be a reasonable figure.

Valley Elderberry Longhorn Beetle

Mitigation for the beetle was analyzed using the 1994 General Compensation Guidelines for the Valley Elderberry Longhorn Beetle from the FWS.

- The three shrubs would be transplanted, and an additional 0.37 acre of habitat would be needed. The mitigation would take place at the existing mitigation site for Phase II of the System Evaluation. Mitigation "credits" for work deleted from the project are available at that site for effects to the valley elderberry longhorn beetle.

- This mitigation has been coordinated with FWS.

4.8 EFFECTS ON CULTURAL RESOURCES

Consideration will be given first to measures that would avoid effects to and preserve cultural resources within the APE. These measures could include relocating roads and the borrow/disposal site, stabilizing banks with a potential for sloughing, and covering sites with protective caps or fill.

When avoidance is not possible, however, effects to cultural resources are determined under the "criteria of effect" as defined in Protection of Historic Properties (36 CFR 800.9). These regulations implement Section 106 of the National Historic Preservation Act. An "adverse effect" diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property.

- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualifications for the National Register.
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
- Neglect of a property, resulting in its deterioration or destruction.
- Transfer, lease, or sale of the property.

All five criteria of adverse effect could be applied to some of the cultural resources in the project area. For the final EIS/EIR, these adverse effects are considered to be significant if the affected property is a site, building, structure, or object which is recognized as culturally or historically significant based on the following institutional, public, or technical criteria.

Institutional Recognition of Cultural Resources

National Historic Landmarks and the National Register of Historic Places are the primary forms of institutional recognition of cultural resources used by Federal agencies. With the passage of the Historic Sites Act of 1935 (16 United States Code (U.S.C.) 461), Congress established a national policy to preserve for public use historic sites, buildings, and objects of significance for the inspiration and benefit of the people of the United States. The National Historic Preservation Act of 1966 (16 U.S.C. 470), as amended, forms the underlying structural basis of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources.

National Historic Landmarks

A National Historic Landmark is a district, site, building, structure, or object that the Secretary of the Interior has determined to be exceptionally valuable in commemorating or illustrating the history of the United States and which has been so designated under the authority of the Historic Sites Act of 1935. Acts of Congress and Executive Orders may also create historic areas of the National Park System, all or part of which may be determined to be of historic significance consistent with the intent of Congress. There are no National Historic Landmarks or National Parks within the study area.

National Register of Historic Places

The National Historic Preservation Act of 1966, as amended, authorizes the Secretary of Interior to expand and maintain a National Register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. The National Register is the authoritative guide used by Federal, State, and local governments, private groups, and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction of impairment (36 CFR 60).

Four criteria are applied to evaluate properties for the National Register (36 CFR 60.4). These criteria were worded to provide for a wide diversity of resources. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- That are associated with events that have made a significant contribution to the broad pattern of our history; or
- That are associated with the lives of persons significant in the past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinctive entity whose components may lack individual distinction; or
- That have yielded or may be likely to yield information important in prehistory or history.

State Historic Landmarks

Historic landmarks are sites, buildings, or features which are considered important enough to deserve landmark status. To be designated a State Historic Landmark, a site must be of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Landmarks are officially designated by the California State Historical Resources Commission. The nine-member commission is appointed by the Governor (Office of Historic Preservation, 1990).

Points of Historical Interest

These are sites of local interest. They may be registered as a point of historical interest if so recommended by a county board of supervisors and approved by the State Historical Resources Commission (Office of Historic Preservation, 1990).

Significance Based on Public Recognition

The American Society of Civil Engineers established a national committee in 1964 in order to recognize and identify the Nation's significant civil engineering works. Projects which represent a significant facet of civil engineering and which are also of historic engineering interest may be designated as national or local Historic Civil Engineering Landmarks.

Other private organizations also recognize and mark historic sites in California. These include the Native Daughters of the Golden West, Native Sons of the Golden West, Daughters of the American Revolution, and E. Campus Vitus.

Popular literature is also a source of public recognition. Historic Spots in California (Hoover et al., 1990) was first published in 1932 as an effort to commemorate and preserve California history. Now in its fourth edition, the book continues to reflect the public's interest in sites designated by Federal, State, or local governments and private organizations. The history of specific locations within the study area can also be found in published accounts such as California Place Names (Gudde, 1960).

Significance Based on Technical Recognition

Archeological resources are the prehistoric and historic material remains of past human life or activities. They are nonrenewable resources, that is, the cultural practices of the ethnic groups or societies with whom the resources are associated usually no longer exist. Resources are of archeological interest when they are capable of providing scientific or humanistic understanding of past behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation. Preservation of archeological resources is important because no one can predict future technology for the study of these sites or determine what research questions will be important in the future.

Federal land managers are required to provide protection to archeological resources located on public lands and Indian lands of the United States in

accordance with provisions of the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa), as amended. Protection must be afforded to these resources regardless of whether they have been listed or determined eligible for the National Register.

4.8.1 Alternative 1

Even under the no-action alternative, some cultural resources may remain at risk. Urban expansion and agricultural practices could affect cultural resources by destroying or damaging them. Natural processes such as erosion, root and rodent intrusion, flooding, and grazing could destroy prehistoric sites. Vandalism, through deliberate looting and collecting, is a national problem and is expected to continue.

4.8.2 Alternative 2

No known historic properties are present within the project's APE. However, portions of the APE in all three reaches have yet to be surveyed for cultural resources. A draft Memorandum of Agreement (MOA) has been forwarded to the State Historic Preservation Officer (SHPO) that stipulates that surveys and evaluations will be conducted prior to the initiation of construction. The MOA will ensure that the Corps will be in compliance with the Section 106 process prior to construction. The draft MOA is included in Appendix B.

4.8.3 Alternative 3

The procedure would be the same as Alternative 2.

4.8.4 Mitigation

If adverse effects to cultural resources are identified under the provisions of the draft MOA, mitigation of those effects would be accomplished under a new MOA between the Corps, non-Federal sponsor, SHPO, and the Advisory Council on Historic Properties as required by Section 106 of the National Historic Preservation Act of 1966, as amended; implementing regulations 36 CFR 800; and Engineering Regulation 1105-2-100. Avoidance or preservation of significant cultural resources would be given foremost consideration when selecting project alternatives. Other mitigation measures could include data recovery through scientific excavation, archival research, recordation, relocation, and purchase of areas with comparable cultural resources.

CHAPTER 5.0

OTHER REQUIRED DISCLOSURES

CHAPTER 5.0

OTHER REQUIRED DISCLOSURES

5.1 INTRODUCTION

This chapter describes other statutory requirements not discussed elsewhere in the EIS/EIR. Cumulative effects and growth-inducing effects are discussed along with unavoidable adverse effects, the relationship of short-term uses and long-term productivity, and irreversible and irretrievable commitments of resources. A section describing mitigation and environmental monitoring for the project is included and a section describing the project's compliance with applicable laws, policies, and plans. Lastly, public involvement associated with the project is discussed.

5.2 CUMULATIVE EFFECTS

National Environmental Policy Act (NEPA) regulations and the CEQA Guidelines require that an EIS/EIR discuss project effects that, when combined with the effects of other projects, result in significant cumulative effects. The NEPA regulations define a cumulative effect as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taken over a period of time (40 CFR 1508.7).

The CEQA Guidelines require that an EIR discuss cumulative effects "when they are significant" (Section 15130). The CEQA Guidelines define cumulative effects as "two or more individual effects which, when considered together, compound or increase other environmental impacts" (Section 15355). Additionally, the CEQA Guidelines state, "The cumulative impacts of several projects, is [defined as] the change in the environment which results from the

incremental impact of the project when added to other closely related past, present, and reasonable foreseeable actions" (Section 15355).

The discussion of cumulative effects must reflect the severity of the effects and their likelihood of occurrence; however, the discussion need not evaluate cumulative effects to the degree of specificity required for project-specific effect analysis. The CEQA Guidelines state that the discussion of cumulative effects should ultimately be guided by the standards of practicality and reasonableness (Guidelines Section 15130).

5.2.1 Methodology

The cumulative effects section includes a general discussion of existing and future projects in the study area. Since it is difficult to identify and analyze all potential future projects that would be constructed in Yuba County, the cumulative effects discussion focuses on the types of projects that could occur in the study area. Effects are evaluated by identifying other projects which, in addition to the project alternatives, could have significant cumulative effects in the study area. The discussion includes a summary of the expected environmental effects of these projects and an evaluation of the cumulative effects. Mitigation for cumulative effects is also discussed.

5.2.2 Related Projects in the Study Area

Several related types of projects exist or are planned in the study area: flood and debris control, water supply, recreation, transportation, and urban/residential. These projects are located on the Yuba and Feather Rivers and tributaries, around Marysville, Linda, Olivehurst, and smaller communities, and in agricultural areas.

Water resource development on the main stem of the Yuba River includes New Bullards Bar Dam near the confluence with the South Yuba River and Daguerre Point Dam below Englebright Dam. New Bullards Bar Reservoir was completed in 1969 by the Yuba County Water Agency and is located about 30 miles northeast of Marysville. The project was built for irrigation, power generation, flood control, and recreation. The facility includes power generating facilities at the New Narrows and New Colgate powerhouses on the main stem of the river, and another at the New Bullards Bar Dam. Daguerre Point Dam is located 11 miles upstream of Marysville, and Englebright Dam is located 20 miles upstream of Marysville. Both dams were constructed to control mining debris. Daguerre Point Dam has been modified to store and divert water for irrigation while Englebright Dam is also operated for hydroelectric power. The South Yuba-Brophy

and Hallwood-Cordoua Diversions are major irrigation water diversions from Daguerre Point Dam.

Various local interests have constructed other smaller projects in the Yuba River basin. Merle Collins Reservoir, which is located on Dry Creek, was constructed by the Brown's Valley Irrigation District and is operated for irrigation water supply. Eighteen small reservoirs in the upper basin have storage capacities of 1,000 acre-feet or more each. Some of these reservoirs include Lake Spaulding, Bowman Lake, Fordyce Lake, and Scotts Flat Lake. They are used for regulation and diversion of streamflow, hydroelectric power, mining, irrigation, and domestic use.

Water resource development along the Feather River includes Oroville Dam and Reservoir, which are part of the State Water Project. Oroville Dam is located about 4 miles northeast of the city of Oroville and was completed in 1967. It is the highest earthfill dam in the United States and is operated for flood control and irrigation. Flood control operations at Oroville Reservoir are coordinated with Bullards Bar Reservoir according to flood control rules prescribed by the Corps.

The levees in the study area are part of the Sacramento River Flood Control System, which provides flood protection and reduces flood damages along the Sacramento River and its tributaries. The main component of the system is the Sacramento River Flood Control Project, which includes levees, overflow weirs, floodway areas, and numerous other features between Chico Landing and Collinsville. About 170 miles of levees in or near the study area are located on the Yuba, Feather, and Bear Rivers and Best Slough. The levees are maintained by local interests.

The Sacramento River Bank Protection Project is an on-going long-term program that allows the Corps to use erosion control methods and setback levees to maintain the integrity of the flood control project. This project reduces the need for emergency levee repairs, periodic dredging, and loss of land due to bank erosion. However, high sustained floodflows and structural problems can still cause erosion and levee failures, as shown during the 1986 and 1997 floods. During such emergency situations, the Corps and other Federal, State, and local agencies provide personnel, supplies, and equipment to evacuate residents, assess damages, and make repairs. In 1997, major problems in the study area included a levee breach near Arboga on the Feather River and a levee breach about 1 1/2 miles above the confluence of the Bear and Feather Rivers. Levee repairs to return the levees to their original conditions have been completed.

The System Evaluation was initiated in 1987 to evaluate the long-term integrity of the flood control system for the Sacramento River and its tributaries.

The evaluation was divided into five phases. The first two phases included the populated Sacramento Urban and Marysville/Yuba City areas. The other three phases include the Mid-Valley, Lower Sacramento, and Upper Valley areas. Construction of the first phase of the System Evaluation is complete. Phases II and III are currently being constructed, and the work is scheduled to be completed in 1998. Design and environmental studies for Phases IV and V have been completed, and additional design and construction work depend on cost sharing and funding.

All future urban development in the study area will be in accordance with the general plans and regulations of Yuba County and Marysville. Any additional impervious surface areas due to development will cause an increase in runoff during storm events, increasing the threat of flooding in the study area. Urbanization will also increase the need for new recreational and transportation facilities. In response, new parks, community centers, bike trails, and roadway work are planned as described in the local plans.

5.2.3 Evaluation of Cumulative Effects

The proposed project alternatives, in addition to existing and future projects, could result in direct and indirect cumulative effects. Construction activities could have direct adverse effects on remaining natural habitats, including changes in land use and lost or degraded vegetation and wildlife habitat. In addition, direct effects could include increases in noise levels, traffic, and air emissions and decreases in the quality of water resources, esthetics, and recreation. Any indirect effects would be associated with development encouraged by water resources projects.

The proposed project alternatives would have no adverse effects on water quality, fisheries, socioeconomics, recreation, esthetics, or HTRW; therefore, there would be no cumulative effects on these resources from any existing and future projects. There would be temporary increases in noise, traffic, and air emissions. However, since these effects are temporary, significant future cumulative effects are not expected. Permanent effects to vegetation and wildlife would contribute to past and future loss of habitat.

There would be no indirect cumulative effects because the proposed project would not encourage additional future development in the flood plain. Growth in the area is already planned by the County and City of Marysville, and future growth projections assume that there is local flood protection from a 1 in 100 annual event in most areas. With the project, there would be no newly protected areas removed from the 100-year floodplain that could encourage growth. Therefore, local growth would continue with or without the project according to current trends. All future growth would be consistent with existing local policies

regarding land use, flood protection, and public safety. All properties would be developed in accordance with the adopted General Plans, land use designations, and zoning regulations.

Reach 1 - Yuba River/Feather River

Potential cumulative effects in reach 1 would likely be both permanent and temporary. Habitat could be permanently affected in agricultural areas which are currently planned for future development. However, most of the future development is planned for areas away from the levees, clustered around existing urban areas such as Linda and Olivehurst. The habitat provided by the levees would not likely be disturbed by future projects unless they include a flood control improvement component. Construction projects in reach 1 would cause temporary increases in noise levels, traffic, air emissions, and esthetic effects.

Reach 2 - Feather River

Potential cumulative effects in reach 2 would likely be both permanent and temporary. Habitat could be permanently affected in agricultural areas which are currently planned for future development. However, most of the future development is planned for areas east of Feather River Boulevard, away from the levees. The habitat provided by the levees would not likely be disturbed by future projects unless they include a flood control component. Air emissions would also increase during construction. Since reach 2 is not as urbanized as reach 1, however, the temporary construction effects due to noise levels, traffic, and esthetics would be less significant.

Reach 3 - Marysville Ring Levee

The potential cumulative effects in reach 3 would likely be minimal. There is no future development planned for the waterside of the levees in reach 3. The waterside of the levees is the floodway for Jack Slough and the Yuba and Feather Rivers. On the landside of the levees, the city of Marysville is already highly urbanized so only a few future projects would occur. The habitat provided by the levees would not likely be disturbed unless future flood control projects are planned in this reach. If construction projects in reach 3 occur, they would cause temporary increases in noise levels, traffic, air emissions, and esthetic effects.

5.2.4 Conclusions

Even though the existing and future projects could have significant cumulative effects in the study area, all projects would be required to comply with Federal, State, and local environmental laws and regulations. Adverse effects on

environmental resources would be identified, evaluated, and mitigated or reduced according to legal requirements and public policy. As a result, an attempt would be made to reduce all adverse effects to less-than-significant levels. However, several effects could not reasonably be mitigated to less than significant. These effects include increases in noise levels and decreases in esthetic quality during construction.

5.3 GROWTH-INDUCING EFFECTS

The growth-inducing section of this EIS/EIR is required by CEQA. According to the CEQA Guidelines, a growth-inducing effect is one that could foster economic or population growth or directly or indirectly bring about construction of additional housing in the surrounding environment (Section 15126[g]). This section addresses existing population growth and densities within the study area and examines existing and with-project growth-inducing conditions.

5.3.1 Existing Conditions/No Action

The study area is part of the Central Valley, which in general is experiencing one of the largest growth rates in the State. Much of reaches 1 and 2 have growth and development planned within and near present communities. Growth and development is expected to include higher density urban areas and rural large lot densities, recognizing the need to provide for a variety of lifestyles. Growth in the county is projected to be 105,361 by the year 2020. Reach 3 protects the city of Marysville. Most of the area within the city limits has been developed. There are about 22 acres of residential land and 10 acres of commercial/industrial land that have not been developed. Therefore, limited growth is planned for the future in this reach.

The no-action alternative would not increase the levels of flood protection in the study area. As a result, this alternative would not induce additional growth or development in the study area.

5.3.2 Alternatives 2 and 3

Reach 1 - Yuba River/Feather River

Completion of the proposed levee improvements would provide protection ranging from a 1 in 200 annual event to a 1 in 300 year annual event from the Yuba and Feather Rivers, and Jack Slough. This change would not be expected to encourage additional new growth and development in areas with increased levels of flood protection. Growth in this area is already planned by the County, and all future development would be consistent with existing County policies regarding

land use, flood protection, and public safety. All properties would be developed in accordance with the adopted County General Plan, land use designations, and zoning regulations. In addition, all development would need to comply with environmental laws and regulations and would require approval by local authorities. As a result, the alternatives would not induce additional growth although they may increase the rate of urbanization in this reach.

Reach 2 - Feather River

The growth-inducing effects would be the same as reach 1.

Reach 3 - Marysville Ring Levee

Completion of the proposed levee improvements would not remove any property from the 100-year flood plain because this reach already has flood protection from the 1 in 100 annual event. Since most of the area protected by reach 3 (city of Marysville) has been developed, the alternatives would not induce any additional new growth. Minimum growth in Marysville is already planned by the City, and all future development would be consistent with existing City policies regarding land use, flood protection, and public safety. All properties would be developed in accordance with the adopted City General Plan, land use designations, and zoning regulations. In addition, all development would need to comply with environmental laws and regulations and would require approval by local authorities. As a result, the alternatives would not induce additional growth.

5.4 SIGNIFICANT ADVERSE EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

The CEQA Guidelines state that any significant environmental effects which cannot be avoided if the proposal is implemented must be described. This description extends to those significant effects which can be mitigated but not reduced to a level of insignificance. Implementation of Alternatives 2 and 3 would have significant unavoidable effects on prime and unique farmlands, noise, air quality, vegetation and wildlife, and special status species.

In reaches 1 and 2, there would be losses of 11.24 acres of Prime Farmland and 3.32 acres of Unique Farmland with Alternative 2 and 11.59 acres of Prime Farmland and 1.27 acres of Unique Farmland with Alternative 3. In reach 3, there would be a loss of 1.2 acres of Prime Farmland and 4.4 acres of Statewide Important Farmland for both Alternatives 2 and 3.

Construction equipment and activities on the levees would have adverse noise and esthetic effects on residents, businesses, and public facilities in reaches

1, 2, and 3. Elevated noise levels would be between 76 and 91 dBA for 8 or 9 hours a day during construction. Construction on the levees would occur between 7:00 a.m. and 5:00 p.m. on weekdays and 8:00 a.m. and 5:00 p.m. on weekends. There would be no significant short-term effects on air quality with the project.

Significant unavoidable effects on vegetation and wildlife include the permanent loss of 2.23 acres of woodland habitat. Habitat for special status species such as the giant garter snake, Swainson's hawk, and the valley elderberry longhorn beetle may also be temporarily lost or degraded.

Mitigation measures to reduce or avoid (when possible) these significant project-related effects are discussed in Chapter 4.

5.5 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Although recent changes to CEQA have eliminated the need for EIR's to address the relationship between local short-term uses of the human environment and maintenance of long-term productivity, the requirement is still required by NEPA. This EIS/EIR discusses the cumulative and long-term effects of Alternatives 2 and 3 which adversely affect the state of the environment. The discussion includes effects which narrow the range of beneficial uses of the environment or pose long-term risks to health and safety. Additionally, reasons why Alternatives 2 and 3 are to be justified now rather than reserving an option for further alternatives are explained.

Alternatives 2 and 3 would include flood control measures such as raising levees, constructing or modifying berms and drains, and installing or modifying slurry walls. This work would permanently affect about 34.48 and 30.34 acres, respectively, in the study area. Instead of providing terrestrial habitat for a variety of species, the land would be part of the berm or levee and provide habitat for fewer species including small rodents and mammals. The levees would provide flood control, which is considered a beneficial use to the people who live and work in the flood plain.

The rivers and levees that would be affected by project construction would not undergo any long-term change in their uses. Slurry walls would be installed or modified in existing levees which are already functioning in a flood control capacity. The environmental uses of these areas would not change, and habitat for a variety of species would still exist in the rivers, levees, and stream banks. There would be no adverse effects that would pose a long-term risk to health and safety.

The need for additional flood protection in the study area has been documented in the Feasibility Report and Chapter 1 of this EIS/EIR. A full range of alternatives was considered for this study. Alternatives 2 and 3 produced economic benefits in excess of project costs. On this basis, it can be concluded that the alternatives for flood control would be feasible and that a project should be implemented soon to avoid the risk of future flooding and loss of life.

5.6 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES ASSOCIATED WITH THE PROJECT

In accordance with the CEQA Guidelines (Sections 21083 and 21087), this EIS/EIR discusses any irreversible and irretrievable commitment of resources which would be involved in Alternatives 2 and 3. Significant irreversible environmental changes are defined as uses of nonrenewable resources during the initial and continued phases of the alternatives which may be irreversible since a large commitment of these resources makes future removal or nonuse unlikely.

The primary irreversible commitment of resources associated with the project alternatives would be the permanent change in land use associated with levee raising and construction of berms. This land would become part of the flood control levee system providing flood protection to the study area.

Construction activities would involve the consumption of nonrenewable natural resources such as the soil, cement, and bentonite for slurry wall installation or modification, and petroleum for fuel. The resources used in site preparation, construction material transportation, borrow material transportation, fill material transportation, excavation, and disposal of excess excavated materials would be permanently committed to the project alternatives. In addition, the non-Federal sponsor would use petroleum for fuel in the continued operation and maintenance of the completed project.

However, since the consumption or use of nonrenewable resources is relatively low for the project alternatives, no significant adverse effects are expected.

5.7 MITIGATION AND ENVIRONMENTAL MONITORING

This section discusses the mechanisms needed to ensure that the mitigation measures identified in Chapter 4 would be accomplished. These measures consist of habitat improvements, best management practices, and other actions to reduce, minimize, or compensate for unavoidable effects of the proposed project. The mitigation for this project would be an authorized project feature and would be cost shared by the Federal Government and the project's non-Federal sponsor. In

accordance with Section 906 of the Water Resources Development Act of 1986, mitigation for direct project effects would be accomplished prior to or concurrent with construction. Mitigation measures are summarized in Chapter 2 and are presented in detail in Chapter 4. The mitigation and monitoring plans for vegetation, wildlife, and special status species are discussed in Sections 5.7.2 and 5.7.3.

5.7.1 Best Management Practices

The short-term construction effects on transportation, noise, and air quality would be reduced or mitigated to less-than-significant levels by implementing best management practices or avoidance measures during construction.

5.7.2 Mitigation

Mitigation measures would be implemented to offset adverse effects on vegetation and wildlife and special status species. The Corps and the non-Federal sponsor would be jointly responsible for ensuring the implementation and success of the mitigation.

Mitigation for vegetation and wildlife would include 2.98 acres of woodland habitat and 0.37 acre of habitat for the valley elderberry longhorn beetle. This mitigation would be at the Phase II mitigation site, which is located along the Feather River near the end of Country Club and Anderson Roads. After portions of the Phase II work were deleted from that project, there remained "extra" acres of mitigation habitat already completed at this site. These habitat types include riparian, scrub-shrub, woodland, emergent marsh, and valley elderberry longhorn beetle habitat. This site was selected because of the uncertainty of the biological success of habitats when created on such a small scale. By consolidating the mitigation into large and biologically meaningful parcels, the possibility of success of the mitigation is greatly increased.

Mitigation for special status species would include mitigation for the valley elderberry longhorn beetle and the Swainson's hawk. Mitigation measures were developed using survey reports and mitigation recommendations, existing programmatic agreements, and mitigation guidelines. The proposed mitigation measures for the special status species are described in Section 4.7.4. The mitigation measures would be coordinated with FWS.

5.7.3 Monitoring

Monitoring is the systematic evaluation of the success of the vegetation and wildlife mitigation measures after implementation of the mitigation plans.

Vegetation monitoring focuses on the growth and development of the mitigation plantings to ensure establishment and long-term survival of the new habitats. This monitoring is normally done during the establishment period and then regularly over the long term. In this project, however, the mitigation would be done at an established mitigation site so monitoring would focus on meeting long-term habitat success criteria. Monitoring for special status species mitigation would be done according to FWS criteria for each species.

Currently, the mitigation site is in its third year of maintenance. The non-Federal sponsor would continue to be responsible for monitoring activities at the mitigation site to ensure that the final success criteria are met. This monitoring would be done according to the guidelines established for Phase II of the System Evaluation. When all of the final success criteria are achieved, the mitigation would be considered successful, and update reports would be provided annually. All monitoring reports would be provided to the Corps.

5.8 COMPLIANCE WITH APPLICABLE LAWS, POLICIES, AND PLANS

The relationship of the project alternatives to applicable Federal and State environmental requirements is summarized below. The project will be in compliance with all laws, regulations, and Executive Orders.

5.8.1 Federal Requirements

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.), Historic and Archeological Resources Protection Act (16 U.S.C. 470AA et seq.), Protection of Historic Properties (36 CFR 800), Abandoned Shipwreck Act (43 U.S.C. 2101 et seq.)

These acts and regulations require Federal agencies to take into account the effects of Federal undertakings on historical and archeological resources. Under these requirements, the APE of the selected project shall be inventoried and evaluated to identify historical or archeological properties that have been placed on the National Register of Historic Places and those that the agency and the SHPO agree are eligible for listing in the National Register. If the project is determined to have an effect on such properties, the agency must consult with the SHPO and the Advisory Council on Historic Preservation to develop alternatives or mitigation measures.

Archeological surveys of a portion of the APE have been conducted. Prior to the initiation of construction, an updated records check and field surveys will be conducted as stipulated in an draft Memorandum of Agreement. Should additional

cultural resources be identified during field surveys, evaluations and effect determinations will be made in accordance with the Section 106 review process.

Clean Air Act (42 U.S.C. 1857 et seq. (1990), as amended and recodified, 42 U.S.C. 7401 et seq. (SUPP II 1978))

Section 4.5 of this EIS/EIR discusses the project's effects on local and regional air quality. The section discusses the issues relative to the project's compliance with FRAQMD significance criteria and EPA's adopted *de minimis* thresholds in its general conformity rule. Since the project would have no significant adverse effect on air quality, a conformity determination would not be required. Indirect effects of the project on air quality are also evaluated.

Clean Water Act (33 U.S.C. 1251 et seq. (1976 & SUPP II 1978))

The project complies with the Federal Clean Water Act including Section 404 because project construction will not place any fill in waters of the United States.

Endangered Species Act (16 U.S.C. 1531 et seq.)

Section 7 of the Endangered Species Act requires Federal agencies, in consultation with the Secretary of the Interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species. A list of threatened and endangered species relating to this project was obtained from FWS. A biological assessment was prepared, indicating that the special status species adversely affected by the proposed project would be the valley elderberry longhorn beetle. Preliminary consultation with FWS has been initiated. Mitigation for adverse project effects is described in Section 4.7.4. A biological opinion will be provided by the FWS and included in the final EIS/EIR.

Federal Water Project Recreation Act (16 U.S.C. 460L-5, 460L-12 et seq., and 662)

This act requires Federal projects to consider features which would lead to enhancement of recreational opportunities. Existing recreation opportunities are discussed in Section 3.2.7. To date, the non-Federal sponsor has not expressed interest in developing recreational facilities as part of this project.

Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.)

This act requires Federal agencies to consult with the FWS and State fish and game agencies before undertaking projects that control or modify surface water (water projects). This consultation is intended to promote the conservation of wildlife resources by preventing loss of or damage to fish and wildlife resources and to provide for the development and improvement of fish and wildlife resources in connection with water projects. The FWS and DFG are authorized to conduct necessary surveys and investigations to determine the possible damage to resources and to determine measures to prevent such losses. Representatives of the Corps participated in these studies. The reports and recommendations of FWS and DFG must be integrated into any report that seeks permission or authority to construct a project. This act requires the Corps to incorporate into the project plan "such justifiable means and measures for wildlife purposes as the Corps finds should be adopted to obtain maximum overall project benefits." The final CAR prepared by FWS is included in Appendix A. The mitigation plan was coordinated and developed with the FWS.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

This act requires the full disclosure of the environmental effects, alternatives, potential mitigation, and environmental compliance procedures of the selected project. The final EIS/EIR provides partial NEPA compliance. The final EIS/EIR provides responses to public comments on the draft EIS/EIR (see Appendix D). A Record of Decision will complete the environmental documentation required by the act.

Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.), President's Environmental Message of August 1979, and CEQ Memorandum of August 10, 1980, for Heads of Agencies

The project complies with this act because there are no rivers designated as Wild and Scenic Rivers in the project area.

Executive Order 11988, Flood Plain Management

This Executive Order requires the Corps to provide leadership and take action to (1) avoid development in the base (1 in 100 annual event) flood plain (unless such development is the only practicable alternative); (2) reduce the hazards and risk associated with floods; (3) minimize the effect of floods on human safety, health, and welfare; and (4) restore and preserve the natural and beneficial values of the base flood plain.

To comply with this Executive Order, the policy of the Corps is to formulate projects which, to the extent possible, avoid or minimize adverse effects associated with use of the base flood plain and avoid inducing development in the base flood plain unless there is no practicable alternative. The Yuba River Basin investigation is in compliance with this Executive Order.

The project provides various levels of flood protection to the study area. The proposed levee improvements would be consistent with existing City and County policies regarding land use and flood protection. The study area is expected to be developed in accordance with existing adopted land use designations. Current growth projections for the study area were determined to be the same for with- and without-project conditions. Therefore, the project would not induce any development in the base flood plain. Local entities with oversight of development activities must comply with State-mandated resource protection including the CESA. Accordingly, the natural and beneficial values of the flood plains will be protected as further urban development continues.

Executive Order 11990, Protection of Wetlands

This order directs the Corps to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in implementing civil works projects. The project complies with this Executive Order because there are no wetlands in the project area.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

This order directs all Federal agencies to identify and address adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. Specifically, agencies must collect, maintain, and analyze demographic and economic information when the proposed project would have a substantial environmental, human health, or economic effect on surrounding populations. This project is in compliance with this Executive Order for several reasons:

- The proposed action would have no such substantial direct or indirect effects on the study area. All short-term construction effects would be avoided, mitigated, or reduced, and permanent losses in habitat values would be compensated.

- Flood control alternatives were formulated according to Corps policies and regulations, as well as other Federal guidelines and laws, and were not

designed to provide flood protection or benefit any specific ethnic or socioeconomic group in the community.

- All notices and public documents including the EIS/EIR are concise, understandable, and will be readily accessible to the public via the media, local libraries, and Corps and non-Federal sponsor.

- Public involvement for this study included several meetings open to the public. All public comments via telephone, letter, e-mail, and meetings were considered in the formulation of alternatives and evaluation of effects.

Farmland Protection Policy Act (7 U.S.C. 4201 et seq.)

This act requires a Federal agency to consider the effects of its action and programs on the Nation's farmlands. The Corps provided the NRCS with project maps and descriptions to assess effects on prime and unique farmlands. The NRCS has not completed its evaluation yet but will respond with a Farmland Conversion Impact Rating letter. A discussion of the analysis and effects is included in Section 3.2.3.

5.8.2 State Laws, Regulations, and Policies

California Environmental Quality Act

This document will be adopted as a joint EIS/EIR and will fully comply with NEPA and CEQA requirements.

The Reclamation Board

As the representative non-Federal sponsor of the Yuba River Basin study, The Reclamation Board has primary responsibility for the CEQA review process and project review.

State Water Resources Control Board, Division of Water Quality, and the California Regional Water Quality Control Board, Central Valley Region

The State Water Recources Control Board and the California Regional Water Quality Board for the Central Valley Region review activities that affect water quality in the Central Valley. The Boards administer the requirements mandated by State and Federal law (Clean Water Act). The Regional Water Quality Control Board establishes water quality standards and reviews individual projects for compliance with the standards.

Permits or Approvals Required

An NPDES general permit for construction activities will be acquired from the Central Valley Regional Water Quality Control Board, and a stormwater pollution prevention plan will be developed per the guidelines of the general permit. The NPDES permit will be acquired before construction activities begin. Appropriate water quality certification from the Central Valley Regional Water Quality Control Board will be acquired.

California Department of Fish and Game, Region 2

Generally, the DFG administers the State laws providing protection of fish and wildlife resources. The DFG administers the CESA of 1984. This act requires the non-Federal lead agencies to prepare biological assessments if a project may adversely affect one or more State-listed endangered species.

Permits or Approvals Required. The Reclamation Board as the non-Federal sponsor has initiated coordination with the DFG as required under the CESA. The DFG will issue a biological opinion for the State-listed species affected by the project. All mitigation measures in the biological opinion will be implemented as part of the proposed project.

State Mining and Geology Board

The State and Mining and Geology Board oversees the implementation of pertinent State laws and regulations. One of the laws within its jurisdiction is the Surface Mining and Reclamation Act of 1975 (Public Resources Code, Section 2710, et seq.).

Permits or Approvals Required. The Surface Mining and Reclamation Act requires that an entity seeking to conduct a surface-mining operation obtain a permit from and submit a reclamation plan to the lead agency overseeing that operation. To be adequate, the reclamation plan must contain all categories of information specified in this act. The selected plan for this project involves one activity that may potentially be classified as surface mining. This activity is obtaining borrow material for use in project construction. The Reclamation Board will coordinate any need for a permit with the State Mining and Geology Board.

State Historic Preservation Office

Details on the SHPO are included in Section 4.8.

Permits or Approvals Required. Actions ensuring compliance with Section 106 of the National Historic Preservation Act of 1966 are detailed in Section 4.8.

5.8.3 Local Plans and Policies

This section discusses the degree to which individual project components comply with locally adopted plans and policies. Evaluating the level of compliance with locally adopted plans can be complicated due to the following: (1) the intentionally broad and unspecific goals articulated in local general plans; (2) the potential of a Federal project to influence the location, density, and rate of development in ways that differ from existing local plans and policies; and (3) the currency of local plans.

The study area is located within the jurisdictions of the City and County General Plans. The proposed project is expected to comply with all of the necessary local plans.

Air Pollution Control Districts

The project construction falls under the jurisdiction of the FRAQMD. The District determines whether project emission sources and levels significantly affect air quality, based on standards established by EPA and the California Air Resources Board. The District will first issue a permit to construct, followed by a permit to operate (if needed), which will be evaluated to determine whether all facilities have been constructed in accordance with the authority to construct permit.

Public Works and Transportation Departments

All proposed activity involving the placement of encroachments within, under, or over county or city road rights-of-way must be covered by an encroachment permit. The appropriate local agencies will be consulted by the non-Federal sponsor as necessary to obtain encroachment permits.

5.9 PUBLIC INVOLVEMENT

Throughout the study, the Corps has coordinated closely with the non-Federal cost-sharing sponsor, The Reclamation Board. At the end of the reconnaissance phase of study, a study management team was formed, which consisted of representatives from the cost-sharing partners. This team met as needed. In addition, an Executive Committee, consisting of responsible officers from the cost-sharing partners, was consulted on major management decisions in accordance with the agreement in the Feasibility Cost Sharing Agreement.

Informational meetings were mostly informal and were designed to inform study participants of the progress of the study.

5.9.1 Public Interest

A notice of intent to prepare a draft EIS/EIR was published in the Federal Register in August 1992.

5.9.2 Comments on the DEIS/EIR

A notice of availability of the draft EIS/EIR was published in the Federal Register on February 13, 1998. The draft was distributed for public review in January 1998. A public workshop was also held during the 30-day review period to provide additional opportunities for comment on the draft EIS/EIR. All comments received by March 30, 1998, were incorporated into the final EIS/EIR, as appropriate, and included in Appendix D.

5.9.3 Intended Uses of the EIS/EIR

In March 1990, the Corps completed an Environmental Inventory of the project study area. Several potentially significant adverse effects were identified, and an EIS was deemed necessary, pursuant to CEQA regulations for implementing NEPA procedural provisions (40 CFR 1502.4, 1508.18, and 1508.28). The Reclamation Board, as the non-Federal lead agency for the study, required preparation of an EIR, pursuant to the CEQA Guidelines (Section 21200). The draft EIS/EIR was prepared to satisfy both Federal and State environmental reporting requirements, pursuant to 40 CFR 1506.2(b) (NEPA implementation regulations) and Section 21083.5 of the CEQA Guidelines.

Under CEQA, an Initial Study is prepared to determine whether to prepare a negative declaration or an EIR and to identify effects to be analyzed by an EIR. The Environmental Inventory, which is a more comprehensive evaluation of the project area environment, was used in place of the Initial Study.

The content requirements under CEQA differ somewhat from the requirements under NEPA. Unlike NEPA, CEQA requires discussions of growth-inducing effects, feasible mitigation measures, and additional public notices. Under NEPA, economic effect analyses, particularly benefit-cost studies, are required, but these studies are optional under CEQA. In addition, NEPA requires that all alternatives be analyzed and compared equally. To fully comply with Federal and State requirements, all mandatory elements are included in this joint EIS/EIR.

The EIS/EIR is an informational document. Its purpose is to inform public agency decisionmakers and the general public of the significant effects of the project. The document also identifies ways to minimize significant effects and describes reasonable alternatives to the project (CEQA Guidelines, Section 15121 (a) and 40 CFR 1502.1). Under the CEQA Guidelines (Section 15151), the standard for adequacy is:

"An EIR should be prepared with sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure."

Upon completion of the review process, the final EIS/EIR will be submitted first to the Secretary of the Army, who will issue a Record of Decision regarding the adequacy of the document and the desirability of going forward with the project. If the Secretary reaches a decision in favor of construction, the EIS/EIR will go to Congress, who then decides whether or not to authorize the project. The analyses of the EPA will be considered in the authorization process.

On the State and local levels, the document must be approved first by The Reclamation Board, which functions as a "responsible agency" (CEQA Guidelines, Section 15381) and represents the interests of the affected city and county governments. The Reclamation Board would act as the project's "lead agency" (CEQA Guidelines, Section 15367) and submit the EIS/EIR to the State legislature for authorization. If authorization is received from both the State and Federal legislatures, the project can go to construction.

State and other local agencies may use the final EIS/EIR when they consider permits or approvals that may be associated with the project. Coordination with agencies such as State Mining and Geology Board and FRAQMD may be necessary to obtain permits or approvals.

5.9.4 Agencies, Organizations, and Persons Receiving the EIS/EIR

This section provides a list of Federal, State, regional, and local public and private agencies and organizations to whom a copy of the draft EIS/EIR was distributed and who will receive a copy of this final EIS/EIR for review and comment. In addition to the regulatory agencies, agencies with special expertise

or interest in evaluating environmental issues related to the project are included. Private agencies, organizations, and individuals who may be affected by the project or who have expressed an interest in the project through the public involvement process are also included.

ELECTED OFFICIALS AND REPRESENTATIVES

Governor of California
- Honorable Pete Wilson

United States Senate
- Honorable Barbara Boxer
- Honorable Dianne Feinstein

House of Representatives
- Honorable Wally Herger

California Senate
- Honorable Robert Leslie

California Assembly
- Honorable Bernie Richter

UNITED STATES GOVERNMENT DEPARTMENTS AND AGENCIES

Department of the Interior
- Fish and Wildlife Services, Division of Ecological Services
- Fish and Wildlife Services, Endangered Species
- Geological Survey
- Office of Environmental Project Review

Advisory Council of Historic Preservation
Department of Agriculture
- Natural Resources Conservation Service
- Agricultural Stabilization and Conservation Service

Department of Transportation
- Federal Highway Administration

Council on Environmental Quality
Environmental Protection Agency
Federal Emergency Management Agency

STATE OF CALIFORNIA GOVERNMENT AGENCIES

Office of Historic Preservation
Senate Committee on Natural Resources
Assembly Committee on Water, Parks, and Wildlife
The Resources Agency

Department of Fish and Game
Department of Conservation
Department of Boating and Waterways
Department of Water Resources
The Reclamation Board
California Water Commission
State Water Resources Control Board
Regional Water Quality Control Board
State Lands Commission
State Clearinghouse

LOCAL GOVERNMENT

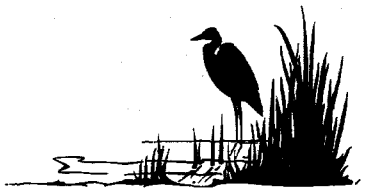
County Board of Supervisors
Mayor of Marysville
Chamber of Commerce
County Flood Control District
County Department of Public Works
Public Utility District
Marysville City Hall
County Planning Department
County Library
Irrigation and Water Districts

ORGANIZATIONS

Audubon Society
California Native Plant Society
California Wildlife Federation
Sierra Club
The Nature Conservancy
Union Pacific Railroad

CHAPTER 6.0

LIST OF PREPARERES



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LIST OF PREPARERS

Name/Expertise	Experience	Role in Preparation
Elizabeth Davis Social Science Environmental Manager	12 years, environmental planning, Corps of Engineers	Socioeconomics and land use analyses
Jerry Fuentes Historian/Social Science	7 years environmental planning, cultural resources management, Corps of Engineers	Historical and cultural resources analysis and coordination; analysis of prime and unique farmlands
Jones & Stokes Associates Sacramento, California	26 years, environmental and planning services	Air quality analysis
Sannie Osborn Chief, Environmental Analysis Section	14 years environmental planning, cultural resources management, Corps of Engineers	Report review and editing
Mark Pelz Biological Science Environmental Manager	4 years environmental planning, Corps of Engineers	Coordination and review of air quality analysis; preparation of maps
Jane Rinck Biological Science Environmental Manager	11 years environmental planning, Corps of Engineers	Report preparation and review
Lynne Stevenson Environmental Writer	12 years planning studies, Corps of Engineers	Report preparation and review
John Suazo Biological Science Study Manager	5 years HTRW program management and base closure oversight, Corps of Engineers	Report review and editing

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REFERENCES

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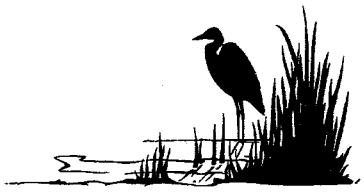

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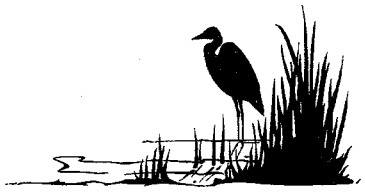
APPENDIX A

COORDINATION ACT REPORT



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE COORDINATION ACT REPORT
FOR THE

YUBA RIVER BASIN INVESTIGATION, CALIFORNIA

PREPARED FOR:
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT, CALIFORNIA

PREPARED BY:
SACRAMENTO FISH AND WILDLIFE OFFICE
SACRAMENTO, CALIFORNIA

OCTOBER 1997

draft

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

IN REPLY REFER TO:
HC-CE

October 29, 1997

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

Subject: CESAC - Yuba River Basin Investigation, Sutter and Yuba Counties, California

Dear Mr. Yep:

Enclosed is the Fish and Wildlife Service's (Service) draft Fish and Wildlife Coordination Act report for the Corps of Engineers' (Corps) flood control improvements proposed as part of the Yuba River Basin Investigation, California.

The information presented in the report is based upon planning information provided by the Corps, a previous planning aid report prepared by the Service, application of Habitat Evaluation Procedures, literature review, and site visits. By copy of this letter we are requesting your agency's, and those agencies listed below, review and comment on the report.

Should you have any questions regarding this report, please contact either Doug Weinrich or Mike Fris of my staff at (916) 979-2107.

Sincerely,

for Wayne S. White
Field Supervisor

Enclosure

cc: FWS, AES, Portland, OR
NMFS, Santa Rosa, CA.
COE, Planning Division, Sacramento (Attn: J. Rinck)
CDFG, Director, Sacramento
CDFG, Reg. Mgr., Region II, Rancho Cordova (Attn: D. Zezulak)
CDFG, Dale Whitmore, Marysville
Reclamation Board, Sacramento (Attn: A. Bronson)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE COORDINATION ACT REPORT
FOR THE

YUBA RIVER BASIN INVESTIGATION, CALIFORNIA

PREPARED FOR:

CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

PREPARED BY:

DOUG WEINRICH
FISH AND WILDLIFE BIOLOGIST
SACRAMENTO FISH AND WILDLIFE OFFICE
SACRAMENTO, CALIFORNIA

OCTOBER 1997

EXECUTIVE SUMMARY

The Corps of Engineers (Corps) and the Yuba County Water Agency and the State Reclamation Board, the non-federal project sponsors, are proposing to increase flood protection in the Yuba River Basin, part of the Feather River Basin, and the city of Marysville, California. This would be accomplished by installing or deepening slurry walls, deepening interior toe drains, constructing or enlarging levee berms, and/or raising levees.

Currently, the Corps is performing remedial repairs to levees in the project area as a result of their Sacramento River Flood Control System Evaluation. That investigation was authorized to evaluate the long-term integrity of the existing flood control system for the Sacramento River and its tributaries. The system evaluation found that levees along the Yuba and Feather Rivers, as well as other parts of the overall flood control system, were susceptable to seepage problems and did not provide the design level of flood protection in some river reaches. The ongoing repair work would restore, but not increase, the design level of flood protection. The Yuba River Basin Investigation is designed to increase the flood protection provided in the project area by adding new work and/or increasing the work (such as constructing deeper slurry walls, larger berms, etc) being done under the system evaluation.

Three specific reaches for work have been identified in the Yuba River Basin Investigation and are described below:

Reach 1 - Feather River/Yuba River. The Feather River/Yuba River reach includes the south levee of the Yuba River, as well as the east levee of the Feather River from its confluence with the Yuba River south to LM (levee mile) 20.0 near Broadway Road. The nearby area includes the cities of Linda and Olivehurst, which are characterized mainly by residential development with limited commercial, industrial, public, and open space land uses.

Reach 2 - Feather River. The Feather River reach includes the east levee of the Feather River from LM 20.0 near Broadway Road to about river mile 15.0. The nearby area is mainly agricultural with some limited industrial development.

Reach 3 - Marysville Ring Levee. The Marysville reach includes the area enclosed by the ring levee surrounding the city. Marysville is the Yuba County seat as well as the largest city in the County. Marysville is mainly residential with some commercial and industrial development.

Three alternatives are being considered in detail. Alternative 1 is the no action alternative and describes the without project conditions. Alternative 2 is the National Economic Development (NED) plan which maximizes the net benefits over costs, and Alternative 3 is the locally preferred plan which provides the level of protection for the study area desired by the non-Federal project sponsors.

The formulation of alternatives was done using a risk-based approach developed by the Corps to analyze the reliability of a channel and levee system, and to develop and analyze flood

control alternatives. The risk-based approach groups areas with similar hydrologic, hydraulic, and economic characteristics together and evaluates each area for economic feasibility. These grouped areas are called index areas. Each index area has an index point, often at the weak or low point of a levee or channel. For each index point there is a frequency-flow, flow-stage, and stage-damage relationship which is assigned to the entire index area. The potential flood control measures are evaluated in terms of the three relationships for each index area. Because each index area has different hydrologic, hydraulic, and economic characteristics, different flood control measures and different levels of protection may be applied to different index areas.

The three alternatives formulated for the project are described in detail in the accompanying report. The level of flood protection provided is summarized by alternative and reach in Table S-1.

Table S-1. Summary of proposed flood protection levels provided by the Yuba River Basin Investigation, California.

ALTERNATIVE	REACH 1 FEATHER/YUBA RIVER	REACH 2 FEATHER RIVER	REACH 3 MARYSVILLE RING LEVEE
Alternative 1 (no action)	65-YEAR	65-YEAR	65-YEAR
Alternative 2 (NED plan)	250-YEAR	200-YEAR	300-YEAR
Alternative 3 (local preferred plan)	200-YEAR	200-YEAR	300-YEAR

The work required to achieve these levels of flood protection generally can be accomplished in the same construction area, as the primary difference is the depth of proposed slurry walls and heights of berms.

The impacts of the proposed project on fish and wildlife resources was evaluated using Habitat Evaluation Procedures (HEP), best professional judgement, and current mitigation guidelines for habitats which provide suitable habitat for listed threatened and endangered species, or species proposed for listing. The project would have temporary impacts on annual grassland and agricultural habitat and permanent impacts on 2.23 acres of woodland habitat. Specific avoidance recommendations for additional impacts to woodland habitat are contained in the recommendations section of the report.

Impacts to annual grassland and agricultural habitat can be minimized by replanting all disturbed areas with native annual grasses at the completion of construction. The results of the HEP shows that the impacts to the 2.23 acres of woodland habitat impacted by project

construction can be compensated by developing 2.98 acres of woodland habitat at a suitable site.

Compensation has been proposed at the site located along the Feather River which was developed as compensation for the adverse impacts of Phase II of the Sacramento River Flood Control System Evaluation work. This site was developed concurrent with the initiation of construction of Phase II remedial repair work. Subsequent to development of the site, some of the construction work was deleted from the Phase II work which has resulted in excess compensation credits being provided at the site. The Corps has used some of this credit for impacts which occurred during levee repairs resulting from the 1997 flooding, and about 5 acres of vegetation were washed away during the 1997 Floods which will not be replanted. There is still sufficient area to use at the site for Yuba River Basin Investigation compensation. However, any future use of this site for compensation credits should be considered only after a formal banking procedure has been developed.

The Federal Endangered Species Act consultation process has not yet been completed for the proposed project, this action will need to be completed prior to the Fish and Wildlife Service's release of a final Fish and Wildlife Coordination Act report. A preliminary review of possible impacts found that three clumps of elderberry shrubs, host plant for the valley elderberry longhorn beetle, would be impacted by the project. Using the current mitigation guidelines for the valley elderberry longhorn beetle, this impact can be mitigated by transplanting the elderberry shrubs and developing an additional 0.37 acres of habitat for the beetle.

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INTRODUCTION

The Corps of Engineers (Corps) and Yuba County Water Agency and the State Reclamation Board, the non-federal project sponsors, are proposing to increase flood protection in the Yuba River Basin, part of the Feather River Basin, and the city of Marysville, California by installing or deepening slurry walls, deepening interior toe drains, constructing berms, and/or raising levees.

Historically, the Feather and Yuba Rivers experienced frequent overbank flooding in the winter and early spring and their channels were migratory, meandering and changing through time. In the mid-1800s hydraulic mining began and was soon washing large quantities of sediment into the rivers and streams reducing channel capacities and increasing flooding. To prevent flooding in the Yuba City/Marysville area and surrounding lands in the Sacramento Valley, levees were constructed along the Feather and Yuba Rivers and their tributaries. These levees were built as a part of the overall Sacramento River Flood Control Project which was authorized in 1917 (Corps of Engineers 1997). In addition, upstream reservoirs were also constructed to assist in flood control.

Despite these flood control improvements damaging floods still occurred in 1950, 1955, 1964, 1986, and most recently in 1997. After the 1986 flooding, the Corps was authorized to evaluate the long-term integrity of the existing flood control system for the Sacramento River and its tributaries (Sacramento River Flood Control System Evaluation). The results of this system evaluation found that levees along the Feather and Yuba Rivers, as well as other parts of the overall flood control system, were susceptible to seepage problems and did not provide the design levels of flood protection in some reaches. Remedial repair work to restore, but not increase, the design level of flood protection is in progress in the Yuba City/Marysville area.

In January 1997, a series of rainstorms lead to a levee break about six miles south of the city of Olivehurst on the east levee of the Feather River. About 100 homes were flooded, and nearly 100,000 inhabitants in the area were evacuated. The levee break occurred in a reach scheduled for remedial repair work later in the year as part of the system evaluation project.

This investigation focusses on flooding problems in the lower Yuba River Basin and part of the Feather River Basin downstream of Oroville Dam. Three specific reaches for work have been identified and are described below:

Reach 1 - Feather River/Yuba River. The Feather River/Yuba River reach includes the south levee of the Yuba River, as well as the east levee of the Feather River from its confluence with the Yuba River south to LM (levee mile) 20.0 near Broadway Road. The nearby area includes the cities of Linda and Olivehurst, which are characterized mainly by residential development with limited commercial, industrial, public, and open space land uses.

Reach 2 - Feather River. The Feather River reach includes the east levee of the Feather River from LM 20.0 near Broadway Road to about river mile 15.0. The nearby area is mainly agricultural with some limited industrial development.

Reach 3 - Marysville Ring Levee. The Marysville reach includes the area enclosed by the ring levee surrounding the city. Marysville is the Yuba County seat as well as the largest city in the County. Marysville is mainly residential with some commercial and industrial development.

DESCRIPTION OF THE AREA

The study area is located in Yuba County about 50 miles north of Sacramento in northern California (Figure 1). The area encompasses the Yuba River Basin and the portion of the Feather River Basin below Oroville Dam. The study is focused on the Feather River, between Honcut Creek and the Bear River, and the Yuba River between river mile 10 (near Daguerre Point Dam) and the river's confluence with the Feather River. The major urban areas near the proposed project are Marysville, Yuba City, Linda, and Olivehurst.

The Yuba River drainage area is about 1,350 square miles, of which 480 square miles are upstream of New Bullards Bar Dam on the North Fork of the Yuba River. The basin is drained by the North, Middle, and South Fork Yuba Rivers which join upstream of Englebright Reservoir to form the mainstem Yuba River. Daguerre Point Dam, an old debris dam, is located downstream of Englebright Dam.

The Feather River drains about 3,600 square miles upstream of Oroville Dam. Oroville Dam is part of the State Water Project and is operated for flood control and water supply. Between Oroville Dam and the Marysville/Yuba City area, the Feather River drains an additional 370 square miles and flows south to its confluence with the Sacramento River.

DESCRIPTION OF THE PROJECT

Three alternatives are being considered in detail. Alternative 1 is the no action alternative and describes the without project conditions. Alternative 2 is the NED plan which maximizes the net benefits over costs, and Alternative 3 is the locally preferred plan which provides the level of protection for the study area desired by the non-Federal sponsors.

The formulation of alternatives was done using a risk-based approach developed by the Corps to analyze the reliability of a channel and levee system, and to develop and analyze flood control alternatives. The risk-based approach groups areas with similar hydrologic, hydraulic, and economic characteristics together and evaluates each area for economic feasibility. These grouped areas are called index areas. Each index area has an index point, often at the weak or low point of a levee or channel. For each index point there is a frequency-flow, flow-stage, and stage-damage relationship which is assigned to the entire index area. The potential flood control measures are evaluated in terms of the three relationships for each index area. Because each index area has different hydrologic, hydraulic, and economic characteristics,

different flood control measures and different levels of protection may be applied to different index areas.

There are three index areas associated with the project which correspond to the reaches described above. Construction measures proposed for these reaches include modifying existing levees by raising and constructing landside berms and drains, modifying existing berms and drains, constructing new berms, installing slurry walls, modifying slurry walls, installing waterside slurry walls, and waterside slurry walls with berms.

Levee raising in most cases involves increasing the "footprint" and height of the levee to provide adequate levee clearance above the water and reduce the risk of overtopping. Levees are usually raised by adding earthfill to the crown and sides of the levee.

Landside berms include constructing vertical and horizontal drains by placing a drainage blanket of crushed rock enclosed in a geotechnical or filter fabric on the levee slope and along the landside levee toe. These drains allow water to pass through the levee without allowing the levee material to escape. The berm is then constructed by placing earthfill on top of the drains and against the levee slope. Landside berms and drains would be modified by deepening the vertical drain, extending the horizontal drain, and extending the berm. Existing berms would be raised by adding earthfill to the top of the berm to increase their height.

Slurry walls are generally used when there is no room to make adjustments to the levee toe to stabilize the levee. Typically the slurry wall is constructed by excavating a trench down the center of the levee or at the levee toe, sufficiently deep to cut-off any seepage paths under the levee. The slurry walls would be modified by increasing the depth of the trench. Slurry walls would also be placed on the waterside either beyond the toe or beneath the exiting levee slope in areas with restricted right-of -way. A berm would be placed over the slurry wall in areas where the wall is placed beyond the levee toe.

The three alternatives formulated for the project are described below:

Alternative 1 (No Action) - Under the no action alternative, no additional Federal action would take place after the remedial repair work currently being constructed as part of Phase II of the Sacramento River Flood Control System Evaluation is completed. The project levees in the study area would provide the design level of flood protection (65-year). The Phase II system evaluation work includes raising levee segments, constructing slurry walls, and constructing landside berms and drains to increase the stability of the levees on the south levee of the Yuba River, east levee of the Feather River, and south levee of Jack Slough. In areas where work from the proposed Yuba River Basin Investigation overlaps system evaluation work, the slurry wall depths proposed in the Yuba River Basin Investigation will be constructed since construction is underway. There would continue to be a flood threat to lives and property due to high runoff and stress to the existing flood control system.

Alternative 2 (NED Plan) - This plan includes the most cost-effective flood control measures for each reach (index area). To achieve maximum cost-effectiveness, the level of protection may vary for each reach. Construction would begin in the year 2000 and be completed in 2 seasons, between April and November each year. The work proposed for each of these three reaches is described below:

Reach 1 - Yuba River/Feather River. On the south levee of the Yuba River and the east levee of the Feather River, flood control measures would include increasing the slurry wall depths of the Phase II system evaluation work (construction is underway); levee raising, constructing berms and drains, modifying berms and drains of the Phase II system evaluation work; and installing new slurry walls. This alternative would provide 250-year protection in this reach. The proposed work is summarized in Table 1 for each alternative and reach.

A 15-acre staging area near Dantoni Road would be used to mix the cement and other materials which would be pumped into the slurry wall trench. No additional lands would be needed for construction.

Levee raising would be done from the landside of the levee in this reach. When the levee is raised less than 0.5 foot, the work would be done within the existing levee embankment limits, and no additional lands would be required. If the levee is raised more than 0.5 foot, a 10-foot permanent easement and a 30-foot temporary easement for the existing levee toe would be needed. In Reach 1, levees would be raised between 0.2 and 3.0 feet.

Berms with drains would be constructed from the landside of the levee and would need a 10-foot permanent easement and a 30-foot construction easement from the new levee toe. The new berm heights and widths in this reach would range from 5 feet high and 10 feet wide to 11 feet high and 18 feet wide. Vertical drain depths would average 12 feet. Horizontal drains are about 4 feet deep and extend the width of the berm.

Modifying the berms and drains of the Phase II system evaluation work would include increasing the berm heights and vertical drain depths and extending the horizontal drains. Vertical drain construction is done underneath the levee berm, which precludes future deepening without removal of the berm. Therefore, the vertical drain modifications will be completed as part of the Phase II system evaluation work. Horizontal drains and berms would be completed as part of the proposed project. These modifications would be completed by adding material to the existing levee slope. The berm heights would vary from 6 to 11 feet, widths would vary from 9 to 18 feet, and the vertical drains would be deepened 1 to 2 feet. A 10-foot permanent easement and a 30-foot temporary construction easement would extend from the new toe of the berm. A borrow and disposal area would needed for the berm and drain construction. The tentative location is on Ella Road in Yuba County. New slurry wall

Table 1. Summary of the work by alternative for the Yuba River Basin Investigation.

STUDY AREA LOCATION (LEVEE MILE)	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (NED PLAN)	ALTERNATIVE 3 (LOCAL PLAN)
REACH 1 - YUBA RIVER			
0.00-0.28[2]	No work	Increase slurry wall depth and raise levee (1.5')	Increase slurry wall depth and raise levee (0.5')
0.28-0.35	No work	No work	No work
0.35-0.92	No work	levee raise with berm (10' x 18') and drain, raise levee 0.5'	Berm (9' x 16') and drain
0.92-1.23	No work	Slurry wall and levee raise 0.7'	Slurry wall
1.23-1.79[2]	No work	Increase slurry wall depth	Increase slurry wall depth
1.77-2.18[1]	No work	Modify berm (10' x 20') and drain, raise levee 0.2'.	Modify berm (9' x 18') and drain
2.18-2.22	No work	No work	No work
2.22-2.97[2]	No work	Increase slurry wall depth	Increase slurry wall depth
2.92-3.56[1]	No work	Modify berm (9' x 16') and drain	Modify berm (8' x 16') and drain
3.56-3.59	No work	Raise levee 0.7 ft, berm (9' x 20') and drain	Berm (8' x 16') and drain
3.59-3.86[1]	No work	Modify berm (9' x 16') and drain	Modify berm (8' x 16') and drain
3.86-4.00	No work	No work	No work
4.00-4.261	No work	Modify berm (6' x 12') and drain	No work
4.26-4.56	No work	Berm (5' x 10') and drain	No work
REACH 1 - FEATHER RIVER			
20.00-20.49	No work	Raise berm 3'	Raise berm 2'
20.49-21.42	No work	Modify berm (10' x 16') and drain	Modify berm (9' x 14') and drain
21.42-22.25	No work	Modify berm (11' x 16') and drain	Modify berm (10' x 14') and drain
22.25-23.64	No work	Modify berm (11' x 18') and drain	Modify berm (10' x 16') and drain
23.64-25.12	No work	Slurry wall and raise levee 1.0'	Slurry wall
25.12-26.07	No work	Increase slurry wall depth, raise levee 0.5'	Increase slurry wall depth, raise levee 0.5
REACH 2 -FEATHER RIVER			
15.98-16.61	No work	Modify berm (10' x 16') and drain	Modify berm (9' x 14') and drain
16.59-17.12	No work	Increase slurry wall depth	Increase slurry wall depth
REACH 3 - YUBA RIVER			
0.00-1.00	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (28' deep) and berm
REACH 3 -FEATHER RIVER/ JACK SLOUGH			
0.00-0.25	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (30' deep) and berm
0.25-0.68	No work	No work	No work
0.68-3.25	No work	Waterside slurry wall (30' deep) and berm	Waterside slurry wall (30' deep) and berm
REACH 3 - MARYSVILLE RING LEVEE			
25.81-26.21	No work	Waterside slurry wall (28' deep) and berm	Waterside slurry wall (26' deep) and berm
26.21-27.08	No work	Waterside slurry wall (38' deep) and berm	Waterside slurry wall (36' deep) and berm

1. Toe drain deepened as Section 104 credit work under Sacramento River Flood Control System Evaluation, Phase II, Contract 2B.
2. Slurry wall deepened as Section 104 credit work under Sacramento River Flood Control System Evaluation, Phase II, Contract 2A.

construction would be done from the top of the levee as described for slurry wall deepening.

Reach 2 - Feather River. The work proposed for Reach 2 is described by levee mile in Table 1. Originally, Phase II system evaluation work planned within Reach 2 extended from LM 20.00 to LM 15.98 on the east levee of the Feather River. However, prior to construction the work between LM 20.00 and LM 17.12 was changed from berm and drain work with levee raising to slurry wall. The change was made as a result of a levee break during the 1997 flood event as slurry walls are a more effective solution to seepage problems. With a slurry wall, seepage energy is reduced to a level which does not threaten the structural integrity of the levee system.

Construction would take place as described for Reach 1. A 9-acre staging area would used between Broadway and Anderson Roads. The borrow and disposal sites would be as described for Reach 1. This alternative would provide 200-year protection for Reach 2.

Reach 3 - Marysville Ring Levee. A ring levee currently protects Marysville from flooding by the Yuba River, Feather River, and Jack Slough. The proposed work would take place on the north levee of the Yuba River, south levee of Jack Slough, and east levee of the Feather River. Flood control improvements are described by levee mile in Table 1 and include waterside slurry wall and berm construction. At one location, LM 0.25 to LM 0.68 along Jack Slough, the increased slurry wall depth has already been constructed as part of the Phase II system evaluation work. Construction for Reach 3 would take place from the waterside of the levee because of the close proximity of structures on the landside (Marysville side) of the levee.

There are two types of slurry wall designs for this reach. The first design includes excavation for the slurry wall beyond the existing toe of the levee. The slurry wall would be installed and backfilled with an impervious material, earthfill, and filter fabric which would form the new berm. The easements needed for this design would be a 10-foot permanent and 30-foot construction easement beyond the toe of the new berm. The new berms would be about 12 feet wide. The second design would be used where there are right-of-way or environmental restrictions on the waterside of the levee. This design would excavate a portion of the existing levee slope and install the slurry wall underneath the levee slope. There would be no berm with this design. Both of the slurry wall designs would correct foundation seepage problems, and the costs would be similar. The easements needed for this design would be a 30-foot construction easement from the existing levee toe. Two staging areas have been identified. The first staging area would be a 4-acre site located along Jack Slough Road, and the other staging area would be a 3-acre site near the Marysville Public Works Center. This alternative would provide 300-year protection for this reach.

Alternative 3 (Locally Preferred Plan) - This alternative was formulated to meet the non-Federal sponsor's goal of 200-year flood protection for the entire study area, except Marysville which would get a 300-year level of protection. The plan components are described in Table 1. Generally, the work proposed in Alternative 3 would consist of the same measures as Alternative 2, but the heights and/or depths would be adjusted for the difference in the level of flood protection that would be provided. The construction schedule, methods, easements, and staging, borrow, and disposal sites would be the same as in Alternative 2

MITIGATION POLICY AND RESOURCE CATEGORY DETERMINATION

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Fish and Wildlife Service's (Service) 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 or conserve fish and wildlife resources. 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 the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural 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 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. The Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources, however.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (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. (Note: Evaluation species used for Resource Category determinations may or may not be the same evaluation species used in a Habitat Evaluation Procedures application, if one is conducted.) 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 planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses would need to be replaced in-kind. "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.

In addition to mitigation planning goals based on habitat values, Region 1 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage for wetland habitat. This goal is applied in all impact analyses.

Three fish and/or wildlife habitats were identified in the Yuba River Basin Investigation project area which had potential for impacts from the project. These are woodland, annual grassland, and agriculture. The resource categories, evaluation species, and mitigation planning goal for the habitats possibly impacted by the project are summarized in Table 2.

Table 2. Evaluation species, resource categories, and mitigation planning goals for the habitats within the study area of the Yuba River Basin Investigation, California.

HABITAT	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Woodland	Passerine birds Raptorial birds Small mammals	2	No net loss of in-kind habitat value or acreage.
Annual Grassland	Raptorial birds	4	Minimize loss of habitat value.
Agriculture	Small mammals	4	Minimize loss of habitat value.

The evaluation species selected for woodland habitat in the project area were passerine and raptorial birds, and small mammals. The birds were selected because of: (a) their dependence on riparian and other woody habitats for feeding, nesting, and migration, (b) their ability to represent other riparian oriented birds, (c) their importance for nonconsumptive human uses (i.e., bird watching), and (d) the Service's responsibilities for their management, under the Migratory Bird Treaty Act. Small mammals were selected because they are ground dwellers, and they have an important role as prey in the food chain for birds, reptiles, and other larger mammals.

Woodland habitat is defined for this project as woody vegetation (primarily riparian and remnant riparian stands) composed predominately of trees and shrubs. Stands of this habitat occur in the project area along levees and agricultural drainage ditches. These stands are generally scattered with their canopy areas ranging from only to a few trees to hundreds of feet wide. Woodland habitat has been severely degraded in the project area and ecoregion in general due to overall habitat loss, fragmentation, and disturbance of existing habitat. Remaining stands of this habitat are extremely valuable to the evaluation species and wildlife species in general. This habitat,

particularly riparian stands, supports a wide variety of plant and wildlife species whose numbers are disproportionately large relative to the area of available habitat. The diversity of species supported by riparian habitat rests on a combination of enhanced surface and groundwater availability, soil fertility, nutrient availability, vegetative layering to form a variety of microclimates, and the role in providing migration routes. Because of its high value to the evaluation species, and its relative scarcity, the Service designates the riparian habitat in the project area potentially impacted by the project as Resource Category 2. Our associated mitigation planning goal is for "no net loss of in-kind habitat value or acreage".

Raptorial birds were selected as the evaluation species for the annual grassland habitat in the project area. These species were selected because they: (a) use this habitat to hunt prey species, (b) their importance for nonconsumptive human uses (i.e., bird watching), and (c) the Service's responsibilities for their management, under the Migratory Bird Treaty Act. This habitat is generally a contiguous area of primarily herbaceous plants such as grasses (i.e., wild oats, rip-gut brome, Bermuda grass, annual and perennial rye), sedges, forbs (i.e., clover spp., vetch, star thistle, dove weed) and various weeds and has been reduced in extent due to conversion to agriculture. Generally this habitat has low-to-moderate habitat values and is fairly common regionally and statewide. Therefore, the Service designates the annual grassland habitat in the project area potentially impacted by the project as Resource Category 3. Our associated mitigation planning goal is to "no net loss of habitat value while minimizing loss of in-kind habitat value".

Small mammals were selected as the evaluation species for the agricultural lands in the project area. Small mammals were selected because of their important role in the food chain as prey species for raptors and larger mammals which forage on these lands. Typically, agricultural lands in the project area are characterized by intensive farming and are very common in the Sacramento Valley. Typically, the agricultural lands are relatively low in value compared to natural habitats. The type of crop grown and post harvest land management practices affect the value of the of these lands for wildlife (crop type is usually a key factor in assigning value); therefore, the Service designates the agricultural habitat in the project area potentially impacted by the project as Resource Category 4. Our associated mitigation planning goal is "minimize any loss of habitat value".

BIOLOGICAL RESOURCES

EXISTING CONDITIONS

Vegetation - The major habitats along the Feather and Yuba Rivers include riparian woodland, scrub-shrub, shaded riverine aquatic cover, annual grassland, and agricultural lands (primarily fruit and nut orchards). Dominate woody plant species along the Feather and Yuba Rivers include large mature willow, cottonwood, and valley oak, with a scrub-shrub understory of blue elderberry, blackberry, young willows and cottonwoods, and various forbs and grasses.

Significant stands of riparian vegetation occur within the confines of the Feather River from the confluence of the Bear River upstream to near Thermalito Afterbay. The Oroville

Wildlife Management Area, a 5,000-acre property owned and maintained by the California Department of Fish and Game, lies in this reach near the afterbay. The 78-acre compensation site for the remedial repair work completed in Phase II for the Sacramento River Flood Control System Evaluation is also located in this reach. On the Yuba River significant stands of riparian vegetation are less common, and become sparser proceeding downstream, typically consisting of intermittent, narrow strips of mature cottonwood and willow trees with a blackberry understory.

Shaded riverine aquatic cover occurs in isolated areas along both the Feather and Yuba Rivers. This habitat is the nearshore aquatic zone where the adjacent riverbank is typically composed of natural substrates and supports riparian vegetation that either overhangs or protrudes into the water (USFWS 1992). It usually occurs, and has its highest habitat value, along banks which have not been riprapped. However, in rare instances where woody vegetation has been allowed to freely recolonize riprapped banks, major attributes of the cover can become reestablished.

Annual grassland and agricultural lands are the most abundant vegetation immediately landward and waterward of the levees. Annual grassland occurs on the existing levees and adjacent lands which have not been developed or converted to agricultural uses. Agricultural lands near the levees in the project area consist mainly of fruit and nut orchards.

The acreages impacted by the proposed project are summarized by alternative and reach in Table 3. Woodland habitat comprises 2.23 acres of the total acreage impacted. The remainder is agriculture and annual grassland habitat.

Wildlife - The Yuba and Feather River basins support many wildlife species. Significant numbers of waterfowl and shorebirds utilize the agricultural fields, seasonal wetlands, dredge ponds, and stream channels in the study area. Common wintering waterfowl species include greater white-fronted goose, Canada goose, Ross' goose, tundra swan, pintail, mallard, gadwall, American widgeon, northern shoveler, wood duck, and green-winged and cinnamon teal.

Woodland habitat and the dredge ponds, in association with herbaceous areas, are utilized by a wide array of upland game, raptor, passerine, and other bird species. Common species include mourning dove, California quail, ring-necked pheasant, wild turkey, red-tailed hawk, Swainson's hawk, red-shouldered hawk, great horned owl, northern harrier, white-tailed kite, yellow-billed magpie, great blue heron, great egret, and various wrens, sparrows, swallows, and flycatchers.

Blacktail deer are permanent residents of many parts of the study area along the rivers. Furbearers inhabiting the basin include raccoon, ring-tailed cat, longtail weasel, river otter, spotted and striped skunk, gray fox, coyote, bobcat, beaver, and muskrat. Most of these species are dependent on riparian and wetland areas. Smaller mammals include gray squirrel, cottontail, blacktailed jackrabbit, California vole, deer mouse, and house mouse.

Table 3. Summary of the acreage impacted by the proposed work in the Yuba River Basin Investigation, California.

REACH	ALTERNATIVE 1 (No Action)	ALTERNATIVE 2 (NED Plan)			ALTERNATIVE 3 (Locally Preferred Plan)		
	No Work	Temporary	Permanent	Total	Temporary	Permanent	Total
Reach 1– Yuba River	0	13.79	10.13	23.92	6.97	6.36	13.33
Reach 1 -- Feather River	0	18.56	8.10	26.66	11.05	7.73	18.78
Reach 2 -- Feather River	0	2.30	1.45	3.75	2.30	1.45	3.75
Reach 3 -- Yuba River	0	3.64	2.60	6.24	3.64	2.60	6.24
Reach 3 -- Feather River /Jack slough	0	11.82	8.80	26.62	11.82	8.80	20.62
Reach 3 -- Marysville Ring levee	0	4.60	3.40	8.00	4.60	3.40	8.00
TOTALS (acres)	0	54.71	34.48	89.19	40.38	30.34	70.72

Fish - Fish resources of the Feather and Yuba Rivers include anadromous species such as chinook salmon, steelhead trout, American shad, striped bass, green and white sturgeon, and Pacific lamprey.

The number of chinook salmon returning as adults to spawn in the Feather River averages nearly 51,000 fish with about 15 percent of these returning to the State's Feather River Hatchery at Oroville. Also about 20,000 steelhead trout use the Feather River for spawning and rearing. Spawning by both species occurs upstream of Marysville. An estimated 250,000 days of effort are annually expended by recreational anglers fishing for salmon and steelhead on the Feather River (USFWS 1993).

There are at least 28 species of resident and anadromous fish in the Yuba River (CDFG 1991). Historically, the Yuba River has supported about 15 percent of the fall-run chinook salmon in the Sacramento River Basin. The lower 24 miles of the river, extending from its confluence with the Feather River at Marysville upstream to Englebright Dam, contains excellent spawning gravels. Presently, chinook salmon and steelhead negotiate fish ladders at Daguerre Point Dam (when sufficient flows are present and the ladders are free of debris) and spawn mainly between Daguerre Point Dam and Englebright Dam. However, in some years, substantial (up to about 50 percent) spawning also occurs in the first 4 miles immediately

downstream of Daguerre Point Dam. The steelhead using the Yuba River are believed to be a self-sustaining population. High water temperatures in the summer and fall seasons make juvenile steelhead vulnerable to loss.

Largemouth and smallmouth bass, Sacramento squawfish, crappie and other centrarchids are common in the lower reaches of the Feather and Yuba Rivers. Other fish species present include catfish, riffle sculpin, speckled dace and Sacramento sucker (CDFG 1991).

Endangered and Threatened Species - The Service provided a list dated August 1, 1997 of the federally-listed threatened, endangered, proposed, candidate species for the project area, as well as species of concern, by USGS quadrangle map.

Seven species listed as threatened were identified including the Aleutian Canada goose, bald eagle, giant garter snake, California red-legged frog, delta smelt, vernal pool fairy shrimp and valley elderberry longhorn beetle. Three species were listed as endangered: American peregrine falcon, vernal pool tadpole shrimp, and Hartweg's golden sunburst. One other species, Central Valley steelhead was listed as proposed for endangered. On August 11, 1997, the National Marine Fisheries Service (NMFS) issued an announcement to defer for 6 months a decision to list Central Valley steelhead due to considerable scientific disagreement about the status of the stock (NMFS 1997).

In addition, one species was listed as a candidate species, the mountain plover. A copy of the above referenced correspondence is included in Appendix A. The California Department of Fish and Game should be contacted regarding State-listed species under the California Endangered Species Act.

FUTURE WITHOUT THE PROJECT

Vegetation - No significant change in woody or herbaceous vegetation is expected on the lands in the project area within project levees. Vegetation on the levees is expected to be maintained as it is currently. Annual grassland and agricultural lands (orchards) on the landward side of the levees, beyond the levee toes, are not expected to change significantly, although some conversion of annual grassland to either agriculture or urban development will likely occur.

Wildlife - Since only minimal changes are expected in vegetation, wildlife populations in the study area are expected to continue as now, with normal year-to-year fluctuations of individual species.

Fish - Future conditions are expected to remain about the same for fish. As with current conditions, populations would fluctuate, depending on the extent of water diversions, water temperature variations, rainfall, pesticide use, and natural population cycles. Conditions may be improved for fish if any action items contained for anadromouse fish are implemented as part of the Central Valley Project Improvement Act

FUTURE WITH THE PROJECT

Vegetation - Construction of the project (either Alternative 2 or 3) will result in the permanent loss of 2.23 acres of woodland habitat and temporary disturbance to all of the agricultural and annual grassland habitat within the construction easement right-of-way. After construction, lands within the permanent easement right-of-way will be restored or converted to annual grassland. The area within the temporary construction easement right-of-way could be retained in annual grassland or used for agricultural purposes.

The loss of 2.23 acres of woodland habitat would result in the loss of 1.54 Average Annual Habitat Units (AAHUs) which was determined using Habitat Evaluation Procedures (Appendix B). This loss occurs with both Alternative 2 and 3 as the same woodland habitat is affected by either alternative. It was further determined that this loss could be compensated over the life of the project by developing 2.98 acres of similar woodland habitat at a suitable site.

Wildlife - The proposed construction activities would have both permanent and temporary impacts on wildlife abundance in the immediate area of construction. The loss of woodland habitat, even though relatively small in size, will permanently reduce the carrying capacity for some wildlife species. Temporary impacts include displacement of species in the area of construction.

Fish - Since the work will not impact any existing aquatic habitat no impact to the fishery in the project area is anticipated.

Endangered Species - A total of three elderberry shrubs were identified as being within the construction right-of-way area. These shrubs contained a total of 15 stems greater than 1-inch in diameter at ground level and less than 50 percent of the stems had exit holes. Using the latest guidelines for valley elderberry longhorn beetle mitigation (USFWS 1996) 0.37 acres of mitigation is required as well as transplanting the 3 elderberry clumps. This information is provided to assist the Corps in meeting its responsibilites under the Federal Endangered Species Act. It does not conclude the official consultation process underway.

DISCUSSION

The proposed work in the Yuba River Basin Investigation largely "piggybacks" work already planned or in construction as part of Phase II of the Sacramento Flood Control System Evaluation. Typical construction is deepening planned slurry walls or raising berms, etc. The work proposed for the Yuba River Basin Investigation will adversely impact an additional 2.23 acres of woodland habitat that is unaffected by currently planned work. Using HEP it was determined this impact could be compensated by developing 2.98 acres of similar habitat at a suitable site (annual grassland or agricultural land). The compensation need for each reach is summarized in Table 4. Impacts to annual grassland and agricultural habitats can be minimized by reseeding all disturbed areas with native annual grasses at the completion of construction.

Table 4. Summary of woodland habitat impacts and compensation needs in the Yuba River Basin Investigation.

ALTERNATIVE 1---NO ACTION			
No impacts/compensation need (no work)			
ALTERNATIVE 2-- NED PLAN			
LOCATION	HABITAT	ACRES IMPACTED	COMPENSATION
Reach 1	Woodland	0.30	0.42
Reach 2	Woodland	0.00	0.00
Reach 3	Woodland	1.93	2.56
	TOTAL	**2.23**	**2.98**
ALTERNATIVE 2 - LOCALLY PREFERRED PLAN			
LOCATION	HABITAT	ACRES IMPACTED	COMPENSATION
Reach 1	Woodland	0.30	0.42
Reach 2	Woodland	0	0
Reach 3	Woodland	1.93	2.56
	TOTAL	**2.23**	**2.98**

A component of Phase II of the Sacramento River Flood Control System Evaluation was development of a 78.5-acre compensation site to offset unavoidable impacts of that project. This site was developed during the first year of project construction along the Feather River near the end of Country Club and Anderson Roads. Subsequent to development of this mitigation site, work proposed in the Phase II system evaluation was reevaluated and portions of the work originally planned in the Phase II system evaluation project area was deleted from the project. The Corps has proposed to use any available compensation "credits" at this site to fulfill the compensation need for the Yuba River Basin Investigation work.

The Service agrees that this is an acceptable approach, provided there are sufficient credits available (a portion of the compensation site was washed away during the 1997 floods, which the Corps does not plan to replant, and some of the impacts from the levee rehabilitation work as a result of the 1997 floods was also to be compensated for on this site). An analysis of the compensation provided by the site and the prior commitment of credits on the site showed that the existing site still has sufficient credits to compensate for this project (HEP Appendix B-3).

Mitigation measures recommended for minimizing impacts to annual grassland and agricultural habitats would consist of replanting disturbed areas with native grass species such as a mixture of purple needlegrass, nodding needlegrass, blue wildrye, creeping wildrye, and California barley on the upper slope of the levee. On the lower slope of the levee a mixture of blue wildrye, Yolo slender wheatgrass, creeping wildrye, and meadow barley would be appropriate. The rate of seeding should range between 2 and 6 pounds per acre for each species. The specific rates for each species can be determined during final project planning.

RECOMMENDATIONS

Based upon the evaluations described herein, the Service recommends that the Corps:

1. Avoid additional impacts to woody vegetation to the maximum extent possible by fencing all areas of woody vegetation within, and immediately adjacent, the construction right-of-way with orange construction fencing and providing written and oral instruction to all contractors not to disturb these areas.

2. Avoid and minimize potential impacts to the giant garter snake by:
   - confining construction activity within or near potential habitat to the period May 1 to October 31.

   - providing construction personnel with worker awareness training by a Service approved biologist. This training instructs workers to recognize giant garter snakes and its habitat.

   - conduct a giant garter snake survey 24-hours prior to construction in potential habitat. A Service approved biologist should be onsite during any clearing or grubbing of wetland vegetation. Clearing should be confined to the minimal area necessary to facilitate construction activities. The snake survey should be repeated if a lapse in construction activity of two weeks or greater occurs.

   - movement of heavy equipment to and from the project site or between the borrow site(s) should be confined to existing roadways to minimize habitat disturbance. Equipment should stay at least 30 feet from the banks of giant garter snake aquatic habitat.

   - any dewatered habitat should remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat.

   - if a giant garter snake is encountered during construction, activities should cease until capture and relocation have been completed by the Service-approved biologist. Any incidental take should be reported to the Service immediately by telephone at (916) 979-2725.

3. Compensate for impacts to 3 elderberry shrubs containing 15 stems greater than 1 inch in diameter at ground level by transplanting the 3 shrubs and developing an additional 0.37 acres of habitat as outlined in the Service's mitigation guidelines for this species.

4. Avoid impacts to any additional elderberry shrubs that may be discovered prior to construction. If impacts are unavoidable, then provide compensation in accordance with the Service's most recent guidelines for the valley elderberry longhorn beetle.

5. Minimize the impacts of the project on annual grassland and agricultural habitats by reseeding all disturbed areas with a mixture of native grasses as construction is completed in each reach. A mixture of purple needlegrass, nodding needlegrass, blue wildrye, creeping wildrye, California barley, Yolo slender wheatgrass, and meadow barley is recommended.

6. Compensate for the loss of 2.23 acres of woodland habitat by committing 2.98 acres of the Sacramento River Flood Control System Evaluation, Phase II mitigation site to the Yuba River Basin Investigation. Prior to construction of Yuba River Basin Investigation, the Corps and Service need to execute an agreement on which lands of the Phase II mitigation site are for (1) system evaluation impacts, (2) levee repairs as a result of the 1997 flood, (3)Yuba River Basin Investigation impacts, (4) which of the mitigation lands will be allowed to remain idle to revegetate naturally, and (5) a methodology needs to be developed to receive any future mitigation credits from the site.

LITERATURE CITED

CDFG (California Department of Fish and Game). 1991. Final Report: Lower Yuba River Fisheries Management Plan. Report No. 91-1. 197 pp.

Corps of Engineers. 1997. Preliminary Draft Environmental Impact Statement for Yuba River Basin Investigation, California. Sacramento District, CA.

NMFS (National Marine Fisheries Service). 1997. Press Release NOAA 97-R155. National Marine Fisheries Service Urges State Participation As It Uses Endangered Species Act To Protect Steelhead In Four Western States.

USFWS (U.S. Fish and Wildlife Service). 1992. Shaded Riverine Aquatic Cover of the Sacramento River System: Classification as Resource Category 1 Under the FWS Mitigation Policy. Sacramento Fish and Wildlife Office report. 21 pp.

_____. 1993. Sacramento River Flood Control System, Phase II. Fish and Wildlife Coordination Act report. Sacramento Fish and Wildlife Office. 187 pp.

_____. 1996. Mitigation Guidelins for the valley elderberry longhorn beetle. Sacramento Fish and Wildlife Office. 10 pp.

APPENDIX A

ENDANGERED SPECIES CONSULTATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

IN REPLY REFER TO:
1-1-97-SP-1791

August 1, 1997

Ms. Jane Rinck
Department of the Army
US Army Engineer District, Sacramento
1325 J Street
Sacramento, California 95814-2922

Subject: Species Lists for a Feasibility Study to Increase Flood Protection for the Areas around Marysville, Linda and Olivehurst, California

Dear Ms. Rinck:

As requested by letter from your agency dated July 23, 1997, you will find enclosed lists of sensitive species that may be present in *or may be affected by* projects in the subject project area (see Enclosure A). These lists fulfill the requirement of the Fish and Wildlife Service (Service) to provide species lists pursuant to section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The animal species on the Enclosure A quad list are those species we believe may occur within, *or be affected by projects within*, the USGS Nicolas, Yuba City, Olivehurst, and Brown's Valley US Geological Survey 7½ minute quads, where your project is planned.

Any plants on the Enclosure A quad list are those *that have actually been observed* in the project quads. The Service recommends that you survey in each quad for plants shown on any of the Enclosure A lists for nearby quads.

Some of the species listed in Enclosure A may not be affected by the proposed action. A trained biologist or botanist, familiar with the habitat requirements of the listed species, should determine whether these species or habitats suitable for these species may be affected by the proposed action. For plant surveys, the Service recommends using the enclosed Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species (Enclosure C).

Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is available upon request. This information may be helpful in preparing the biological assessment for this project, if one is required. Please see

Ms. Jane Rinck

Enclosure B for a discussion of the responsibilities Federal agencies have under section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal agency or its designated non-Federal representative.

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.

Candidate species are currently being reviewed by the 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.

In the Federal Register of February 28, 1996, the Service changed its policy on candidate species. The term *candidate* now strictly refers to species for which the Service has on file enough information to propose listing as endangered or threatened. Former *category 2* candidate species - species for which listing is possibly appropriate but for which the Service lacks sufficient information to support a listing proposal - are now called *species of concern.* They are no longer monitored by the Service. However we have retained them on the enclosed list for general information. We encourage consideration of them in project planning, as they may become candidate species in the future.

Please contact Jan Knight, Sacramento Valley Branch Chief, at (916) 979-2120, if you have any questions regarding the enclosed list or your responsibilities under the Endangered Species Act. For the fastest response to species list requests, address them to the attention of the section 7 office assistant at this address. If you have any questions about possible impacts to other fish and wildlife, please contact Mike Fris at (916) 979-2107.

Sincerely,

Patricia Lemmond

for Wayne S. White
Field Supervisor

Enclosures

Enclosure B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER
SECTIONS 7(a) and (c) OF THE ENDANGERED SPECIES ACT

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 informally verified with our 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 in the BA: an on-site inspection of the area affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat is present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirement; 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, and 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.

Enclosure C

GUIDELINES FOR CONDUCTING AND REPORTING BOTANICAL INVENTORIES FOR FEDERALLY LISTED, PROPOSED AND CANDIDATE PLANTS

(September 23, 1996)

These guidelines describe protocols for conducting botanical inventories for federally listed, proposed and candidate plants, and describe minimum standards for reporting results. The Service will use, in part, the information outlined below in determining whether the project under consideration may affect any listed, proposed or candidate plants, and in determining the direct, indirect, and cumulative effects.

Field inventories should be conducted in a manner that will locate listed, proposed, or candidate species (target species) that may be present. The entire project area requires a botanical inventory, except developed agricultural lands. The field investigator(s) should:

1. Conduct inventories at the appropriate times of year when target species are present and identifiable. Inventories will include all potential habitats. Multiple site visits during a field season may be necessary to make observations during the appropriate phenological stage of all target species.

2. If available, use a regional or local reference population to obtain a visual image of the target species and associated habitat(s). If access to reference populations(s) is not available, investigators should study specimens from local herbaria.

3. List every species observed and compile a comprehensive list of vascular plants for the entire project site. Vascular plants need to be identified to a taxonomic level which allows rarity to be determined.

4. Report results of botanical field inventories that include:

   a. a description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species

   b. a map of project location showing scale, orientation, project boundaries, parcel size, and map quadrangle name

   c. survey dates and survey methodology(ies)

   d. if a reference population is available, provide a written narrative describing the target species reference population(s) used, and date(s) when observations were made

   e. a comprehensive list of all vascular plants occurring on the project site for each habitat type

   f. current and historic land uses of the habitat(s) and degree of site alteration

   g. presence of target species off-site on adjacent parcels, if known.

   h. an assessment of the biological significance or ecological quality of the project site in a local and regional context

5. If target species is(are) found, report results that additionally include:

   a. a map showing federally listed, proposed and candidate species distribution as they relate to the proposed project

   b. if target species is (are) associated with wetlands, a description of the direction and integrity of flow of surface hydrology. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.

c. the target species phenology and microhabitat, an estimate of the number of individuals of each target species per unit area; identify areas of high, medium and low density of target species over the project site, and provide acres of occupied habitat of target species. Investigators could provide color slides, photos or color copies of photos of target species or representative habitats to support information or descriptions contained in reports.

d. the degree of impact(s), if any, of the proposed project as it relates to the potential unoccupied habitat of target habitat.

6. Document findings of target species by completing California Native Species Field Survey Form(s) and submit form(s) to the Natural Diversity Data Base. Documentation of determinations and/or voucher specimens may be useful in cases of taxonomic ambiguities, habitat or range extensions.

7. Report as an addendum to the original survey, any change in abundance and distribution of target plants in subsequent years. Project sites with inventories older than 3 years from the current date of project proposal submission will likely need additional survey. Investigators need to assess whether an additional survey(s) is (are) needed.

8. Adverse conditions may prevent investigator(s) from determining presence or identifying some target species in potential habitat(s) of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. An additional botanical inventory(ies) in a subsequent year(s) may be required if adverse conditions occur in a potential habitat(s). Investigator(s) may need to discuss such conditions.

9. Guidance from California Department of Fish and Game (CDFG) regarding plant and plant community surveys can be found in Guidelines for Assessing the Effects of Proposed Developments on Rare and Endangered Plants and Plant Communities, 1984. Please contact the CDFG Regional Office for questions regarding the CDFG guidelines and for assistance in determining any applicable State regulatory requirements.

ENCLOSURE A
Endangered and Threatened Species that May Occur in
or be Affected by Projects in the Following Selected Quads
Reference File No. 1-1-97-SP-1791
August 1, 1997

QUAD : 529A NICOLAUS

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

QUAD : 529A NICOLAUS

Species of Concern

Mammals

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

QUAD : 543B BROWNS VALLEY

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

QUAD : 543B BROWNS VALLEY

Listed Species

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

spotted bat, *Euderma maculatum* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

QUAD : 543B BROWNS VALLEY

Species of Concern

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

QUAD : 544A YUBA CITY

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

QUAD : 544A YUBA CITY

Listed Species

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Plants

Hartweg's golden sunburst, *Pseudobahia bahiifolia* (E)

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

QUAD : 544A YUBA CITY

Species of Concern

Birds

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

Plants

Ferris's milk-vetch, *Astragalus tener var. ferrisiae* (SC)

QUAD : 544D OLIVEHURST

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

QUAD : 544D OLIVEHURST

Listed Species

Invertebrates

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

QUAD : 544D OLIVEHURST

Species of Concern

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

Plants

veiny monardella, *Monardella douglasii ssp. venosa* (SC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(*)		Possibly extinct.
	Critical Habitat	Area essential to the conservation of a species.

APPENDIX B

HABITAT EVALUATION PROCEDURES

AUGUST 1997

INTRODUCTION

This application of Habitat Evaluation Procedures (HEP) is intended to quantify the anticipated impacts to fish and wildlife resources that would occur with the construction of the proposed flood control improvements for the Yuba River Basin Investigation, and to determine mitigation needs. This HEP addresses the effects of the proposed project on fish and wildlife resources and their habitat.

PROJECT DESCRIPTION

Three alternatives were considered in detail and retained for further study. Alternative 1 (No Action) is the without project condition. Alternative 2 is the NED plan which maximizes net benefits over costs, and Alternative 3 (the locally preferred plan) provides the level of flood protection for the study area desired by the non-federal sponsors.

Alternative 1 would provide about a 65-year level of flood protection. Alternative 2 would provide between 200- and 300-year protection in the study reaches, and Alternative 3 would provide the entire study area with at least 200-year flood protection, Marysville would get a 300-year level of protection.

The construction measures used to achieve these levels of flood protection include modifying existing levees by raising, constructing landside berms and drains, modifying berms and drains, constructing berms, installing slurry walls, modifying slurry walls, and installing waterside slurry walls, and waterside slurry walls with berms. For a complete description of the alternatives and the measures proposed for construction in each reach, see the accompanying Fish and Wildlife Coordination Act report.

HEP DESCRIPTION

HEP[1] is an impact assessment methodology developed by the Fish and Wildlife Service (Service) and other State and Federal resource agencies which can be used to document the quality and quantity of available habitat for selected wildlife species. HEP provides information for two general types of habitat comparisons: 1) the relative value of different areas at the same point in time, and 2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed or anticipated land- and water-use changes on habitat can be quantified. In a similar manner, any compensation needs (in terms of acreage) for the project can also be quantified.

A HEP application is based on the assumption that habitat for selected wildlife species or communities can be described by a model which produces a Habitat Suitability Index (HSI). The HSI, a value from 0.0 to 1.0, is assumed to relate directly to the carrying capacity of the habitat being evaluated. The HSI is multiplied by the area of available habitat to obtain Habitat Units (HUs). Changes in habitat value and quantity are tracked over time at specified time periods known as target years. Those changes over the life of the project are annualized to yield Average Annual Habitat Units (AAHUs). The period of analysis is equal to the life of the

[1]For further information on HEP, see ESM 100-104 which is available from the Service's Sacramento Fish and Wildlife Office.

project plus any construction period. The difference in AAHUs for various project scenarios permit comparison of alternatives. the models used in this HEP are contained in HEP Appendix B-1.

Impacts associated with each future scenario are evaluated for a number of target years. To predict changes in an HSI for each future scenario, it is necessary to make assumptions regarding baseline and future values within project impact and compensation areas. These assumptions are listed in HEP Appendix B-2. Given these assumptions, long-term losses and gains in HUs can then be estimated for each future scenario over the life of the project, then expressed as AAHU gains or losses. The reliability of a HEP application, including the significance of HUs and AAHUs, is directly dependent on the ability of the HEP user(s) to assign a well-defined and accurate HSI to the selected evaluation species or communities. Also, the HEP user(s) must be able to identify and measure (or predict) the area of each distinct habitat that is utilized by fish and wildlife within the project impact area. Both the HSIs and the habitat acreages must also be reasonably estimable at various future points in time.

A fundamental and critical step in designing any HEP application is the setting of overall goals and objectives. In this HEP application, such goals and objectives were developed based on the overall, long-term resource management goals of the Service. The mitigation policies of the Service (see description within the body of the Fish and Wildlife Coordination Act report) were also carefully considered.

The following goals and objectives were established for the HEP used in this study:

1. The primary goal was to evaluate the impacts on fish and wildlife from the proposed flood control improvements.

2. Quantify habitat conditions before project construction.

3. Quantify habitat conditions after project construction.

4. Develop and evaluate a management alternative designed to compensate impacts from the project.

5. Determine the acreage and habitat values of various habitats necessary to compensate for the impacts of the project on these habitats in the project area.

METHODOLOGY

The 1980 HEP procedures were used in this application which was conducted in August 1997. Participants in the data collection portion of the HEP were representatives from the Service (Doug Weinrich) and Corps of Engineers (Jane Rinck).

As previously stated, the purpose of using HEP is to provide a quantitative basis for identifying the habitat values which would be degraded, destroyed, and/or created by project construction.

Woodland, annual grassland, and agricultural habitats would be affected by the proposed project. The total acreage affected by location is summarized in Table B1.

Table B1. Summary of total acreage impacted by the construction alternatives proposed in the Yuba River Basin Investigation, California.

REACH	ALTERNATIVE 1 (No Action)	ALTERNATIVE 2 (NED Plan)			ALTERNATIVE 3 (Locally Preferred Plan)		
	No Work	Temporary	Permanent	Total	Temporary	Permanent	Total
Reach 1– Yuba River	0	13.79	10.13	23.92	6.97	6.36	13.33
Reach 1 – Feather River	0	18.56	8.10	26.66	11.05	7.73	18.78
Reach 2 – Feather River	0	2.30	1.45	3.75	2.30	1.45	3.75
Reach 3 – Yuba River	0	3.64	2.60	6.24	3.64	2.60	6.24
Reach 3 – Feather River /Jack slough	0	11.82	8.80	26.62	11.82	8.80	20.62
Reach 3 – Marysville Ring levee	0	4.60	3.40	8.00	4.60	3.40	8.00
TOTALS (ac)	0	54.71	34.48	89.19	40.38	30.34	70.72

Much of the proposed Yuba River Basin Investigation work overlays the project area of Phase II of the Sacramento River Flood Control System Evaluation which is completing its second year of construction. In order to ensure the impact analyses for the two projects are comparable, the HEP Team elected to utilize the same models and procedures used in the systems evaluation HEP. The habitats and HSI models selected to evaluate project impacts are shown in Table B2.

Table B2. Summary of habitats and Habitat Suitability Index (HSI) model selected for use in the Yuba River Basin Investigation impact analysis.

HABITAT TYPE	PROPOSED HSI MODEL
Annual Grassland	Small Mammal Prey-Base Guild
Agriculture	Small Mammal Prey-Base Guild
Woodland	Riparian Forest Cover-Type

Consistent with the previous work completed for the Phase II System Evaluation HEP, it was decided that agricultural (primarily orchards) and annual grassland habitat impacts would not be analyzed using HEP since orchard habitat would be replaced by annual grassland habitat and disturbed annual grassland habitat would be reseeded after construction was completed. Therefore, the only habitat analyzed for impacts with the HEP is woodland. The woodland habitat impacted by the project is summarized by reach in Table B3.

Table B3. Summary of woodland habitat acreages impacted by reach in the Yuba River Basin Investigation.

ALTERNATIVE 1 -- NO ACTION		
No impacts (no new work proposed)		
ALTERNATIVE 2 -- NED PLAN		
LOCATION	HABITAT	ACRES IMPACTED[1]
Reach 1	Woodland	0.30
Reach 2	Woodland	0.00
Reach 3	Woodland	1.93
TOTAL 2.23		
ALTERNATIVE 3 -- LOCALLY PREFERRED PLAN		
Reach 1	Woodland	0.30
Reach 2	Woodland	0.00
Reach 3	Woodland	1.93
TOTAL 2.23		

1. The total acres affected by Alternatives 2 and 3 are different; however, the woodland habitat affected by either alternative is the same.

The Riparian Forest Cover-Type model does not attempt to portray exactly the needs of any one species, but rather it broadly portrays the needs of many species groups of the Sacramento Valley. For example, many birds, including nesting raptors such as the red-tailed hawk and Swainson's hawk, require tall trees, and thus tree height, with taller trees being more favorable, is included as a key model variable. Also, many songbirds, such as the northern oriole, require relatively dense canopies, thus canopy closure, with greater canopy closure providing greater value, is included as a model variable. Similarly, riparian birds such as herons and egrets have specific needs relating to canopy closure, stand width, and understory density, so these needs have been addressed with appropriate model variables.

When using HEP, it is necessary to determine HSIs for each evaluation species at selected target years for both with-project and without-project scenarios. Proposed mitigation areas must be treated similarly (with-management is substituted for with-project conditions). The capacity of each sample site to meet the needs of the evaluation elements within the project impact and compensation areas was determined by the HEP team through measurement of specific habitat variables. Baseline values for each of the model variables can be obtained by field sampling, map interpretation, conversation with recognized experts, and review of existing records and reports. Table B4 lists the variables contained in each model and indicates how data for each variable was collected.

Table B4. Summary of the Habitat Suitability Index (HSI) Model, the variables, and how the values were obtained in the Yuba River Basin Investigation.

HSI MODEL	HSI VARIABLE	HOW OBTAINED
RIPARIAN FOREST COVER-TYPE	V1 - Average tree height	Field measurement
	V2 - Average canopy width of stand	Field measurement
	V3 - Percent tree canopy closure	Field measurement
	V4 - Number of tree/shrub species	Field observation
	V5 - Understory vegetative density	Field measurement

At the completion of data collection, an HSI value was calculated for each evaluation element. A higher numerical rating is indicative of higher suitability for the evaluation element at the sample site. HSI measurements of the same habitat in an impact area were averaged. The HSI, when multiplied by the area of the habitat, yields HUs, a measure of the quality and quantity of the habitat. The equation used to calculate the HSIs is contained within the model (HEP Appendix B1).

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific baseline Suitability Index[2] values for each evaluation species based on the HEP Team's best professional judgement of probable future conditions. The assumptions used to derive future HSI and acreage values for with- and without project conditions on the impact and compensation areas are contained in HEP Appendix B-2.

Given these assumptions, long-term losses and gains in HUs can be estimated for each future scenario over the life of the project, then expressed as AAHU gains or losses. Basic HEP outputs, as expressed on Form Ds are given in HEP Appendix B-3. The HEP 2.2 Accounting Software Package was used to calculate AAHUs.

[2]A Suitability Index is the value obtained for each variable in a HSI model.

In order to make the comparison of future with- and without-project conditions for each alternative described above, it was necessary to first develop the future without-project scenario for the habitats affected within the project area. This necessitated making several key assumptions that existing land uses and maintenance activities would not change in the future without the project. Given these conditions, a future without-project scenario was developed which included: (1) no change in the existing habitat acreages, (2) riparian habitat values will continue to develop, and (3) the existing hydrology will be maintained in the study area.

The existing woodland habitat affected in Reaches 1-3 were 0.30, 0, and 1.93 acres, respectively. Sampling was completed on woodland habitat on the Yuba River near the Caltrans yard and on the north levee upstream of Highway 70; and on Jack Slough north of Marysville and two other sites subsequently dropped from the project.

RESULTS AND DISCUSSION

The results of the HEP analysis indicates that 1.54 Average Annual Habitat Units would be lost with construction of either Alternative 2 or 3. Compensation for this loss could be accomplished on about 2.98 acres of agricultural or annual grasslands which would be converted to woodland habitat. The compensation need for each reach is summarized in Table B5.

A component of Phase II of the Sacramento River Flood Control System Evaluation was development of a 78.5-acre compensation site to offset unavoidable impacts of that project. This site was developed during the first year of project construction. Subsequently, the work proposed in the system evaluation was reevaluated and portions of the work originally planned in the Phase II project area was deleted from the project. The Corps has proposed to use any available compensation "credits" at this site to fulfill the compensation need for the Yuba River Basin Investigation work.

The HEP Team agreed that this was acceptable, provided there were sufficient credits available (a portion of the compensation site was washed away during the 1997 floods, which the Corps does not plan to replant, and some of the impacts of the levee rehabilitation work as a result of the 1997 floods was to be compensated for on this site). An analysis of the compensation currently provided by the site and prior commitments of credits on the site showed that the site still has sufficient credits to compensate for this project (HEP Appendix B-3).

Mitigation measures recommended for impacts to annual grassland and agricultural habitats consist of replanting disturbed areas with native grass species such as purple needlegrass, nodding needlegrass, blue wildrye, creeping wildrye, California barley, meadow barley, and Yolo slender wheatgrass.

Table B5. Summary of woodland habitat impacts and compensation needs in the Yuba River Basin Investigation, California.

ALTERNATIVE 1---NO ACTION			
No impacts/compensation need (no work)			
ALTERNATIVE 2-- NED PLAN			
LOCATION	HABITAT	ACRES IMPACTED	COMPENSATION
Reach 1	Woodland	0.30	0.42
Reach 2	Woodland	0.00	0.00
Reach 3	Woodland	1.93	2.56
	TOTAL	**2.23**	**2.98**
ALTERNATIVE 2 - LOCALLY PREFERRED PLAN			
LOCATION	HABITAT	ACRES IMPACTED	COMPENSATION
Reach 1	Woodland	0.30	0.42
Reach 2	Woodland	0	0
Reach 3	Woodland	1.93	2.56
	TOTAL	**2.23**	**2.98**

HEP APPENDIX B-1

HSI MODELS

HABITAT SUITABILITY INDEX MODEL

RIPARIAN FOREST COVER-TYPE, SACRAMENTO VALLEY

Formulated by the HEP Team for the
Sacramento River Flood Control Evaluation, Phase II

February 1990

BACKGROUND: This particular model was developed for quantifying the impacts of remedial levee repair on areas with limited Riparian Forest Cover within the Sacramento River Flood Control System Evaluation, Phase II project area. This model can also be used for determining the sizes of a managed wildlife area needed for replacing lost habitat values for this cover type.

Riparian Forest Cover is defined as a stand of woody vegetation composed of primarily trees greater than 20-feet-tall. The Riparian Forest cover-type model identifies and quantifies general characteristics of this cover-type which are important to a wide array of wildlife. The model does not attempt to portray exactly the needs of any one species, but rather it broadly portrays the needs of many species or species groups of the Sacramento Valley area.

For example, many birds, including nesting raptors such as red-tailed hawks and Swainson's hawks require tall trees, and thus tree height, with taller trees being more favorable, has been included as a key model variable. Also, many songbirds, such as the northern oriole, require relatively dense canopies, thus canopy closure, with greater closure providing greater value, is included as a model variable. Similarly, riparian birds such as herons and egrets have specific needs relating to canopy closure, width of stand, and density of vegetative understory, so these needs have been met as much as possible with the appropriate model variables.

The single Habitat Suitability Index (HSI) value between 0 and.1.0 which is derived using the Riparian Forest cover-type model is, therefore, not an exact measure of the habitat value to any single wildlife species. Instead, the HSI indicates the overall, broad quality of the cover-type to a broad array of the most important Sacramento Valley species. As such, the use of this single HSI value in the HEP process is assumed to provide the same results (i.e., estimates of relative impacts and compensation needs) as if the HEP were completed using a number of individual wildlife species models for the cover type.

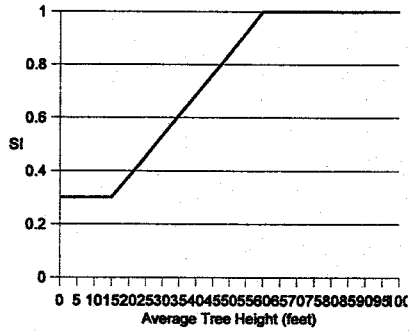
APPLICABLE COVER-TYPES: Riparian Forest Cover of Sacramento Valley and managed wildlife areas which may be developed as mitigation areas.

VARIABLES:

V1 Average tree height.
V2 Average canopy width of the stand.
V3 Tree canopy closure.
V4 Number of tree or shrub species.
V5 Understory vegetative density.

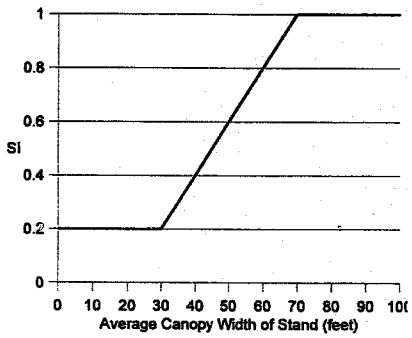
V1 -- Average tree height, Suitability Index (SI) determination.

ASSUMPTIONS: For most wildlife species of concern, the taller the trees, the better the habitat value. Nesting raptors in particular require relatively tall trees. A tree height, on average of about 60 feet or greater, is optimum.



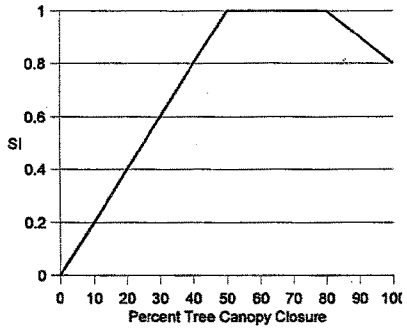
V2 -- Average canopy width of the stand, Suitability Index (SI) determination,

ASSUMPTIONS: Generally, the wider the stand, the better the habitat values for most key fish and wildlife. Stands less than 30-feet-wide have relatively low values; stands over 70-feet in width are best.



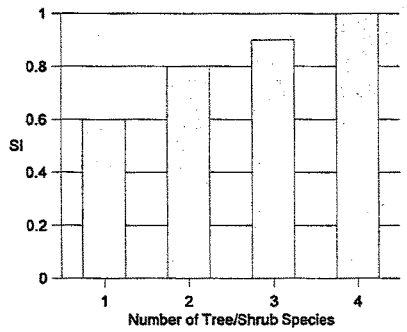
V3 -- Tree canopy closure, Suitability Index (SI) determination.

ASSUMPTIONS: In general, the greater the forest density as determined by percent of canopy closure, the greater the habitat values of the forest. However, if the stand becomes too dense, habitat values frequently decline. The optimal condition is with percent canopy closure of 50 to 80 percent.



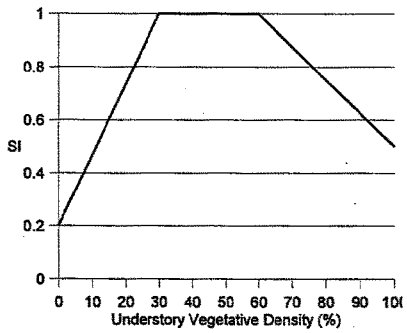
V4 Number of tree or shrub species. Suitability Index (SI) determination.

ASSUMPTIONS: Habitat diversity improves carrying capacity. Generally, the more tree and shrub species present, the more diverse the forest, and the greater the values to fish and wildlife. The optimal condition is when the forest is composed of at least four species of trees.



V5 Understory vegetative density, Suitability Index (SI) determination.

ASSUMPTIONS: The best Riparian Forest habitat occurs when both overstory and understory canopies are relatively dense. The understory should generally have a moderate density of vegetation at various elevations. By estimating the 14-feet above ground, and then averaging these three figures (i.e., the three estimates of percent vegetative cover), a good index of overall understory density can be derived.



HABITAT SUITABILITY INDEX (HSI): Average canopy width and understory density are believed to be slightly more important variables than the other three variables. The five variables are thus combined as follows:

$$HSI = \frac{(V1 \times V3 \times V4)^{1/6} + (V2 \times V5)^{1/4}}{2}$$

DATA COLLECTION

METHODOLOGY

Riparian Forest Cover Type

V1 Average tree height
V2 Average canopy width
V3 Tree canopy closure
V4 Number of trees or shrubs
V5 Understory vegetation density

Measurement Method

Sampling will be conducted on a line transect. Sample locations will be determined by pacing the number of digits selected from a random numbers table. The number of sample sites on each line will vary with the size of the area being evaluated.

V1 Average tree height. A clinometer will be used to determine tree height. If the object being measured is 66 feet away the height can be read directly from the clinometer.

V2 Average canopy width. A tape will be used to measure the width of the stand. The width of the stand will be measured from the outer edge of the canopy.

V3 Tree canopy closure. A spherical densiometer will be used to record total of points intercepted overhead by vegetation. Data will be collected by sequentially observing in four directions (north, south, east, west) at the sample location.

V4 Number of trees or shrubs. Count the number of species of tree and shrub in the stand being evaluated and record on data sheet.

V5 Understory vegetative density. Methods used for V3 will be used for this variable at heights of 2, 6, and 14 feet from the ground, The vegetative density at 6 feet will be assumed to equal the value obtained from V3. The vegetative density at 14 feet will have to be estimated.

HEP APPENDIX B-2

DATA ANALYSIS ASSUMPTIONS

Assumptions:

1. Existing maintenance will continue

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrub species
V5 - Understory vegetative density

TY0 - Baseline (measured)

V1	24 ft	SI = .45
V2	66 ft	SI = .91
V3	69%	SI = 1.0
V4	3	SI = 0.9
V5	50%	SI = 1.0

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(.405^{1/3} + .91)^{1/3}}{2} = \frac{.739 + .95}{2} = .84$$

TY1 No change from TY0
TY2 No change from TY1
TY52 No change from TY2

Future w/ Project (PA2)

Assumptions:

1. All woody vegetation removed
2. Future maintenance activities preclude development of woody vegetation within right-of-way
3. Construction period is one year

TY0 - Baseline (measured)

V1	24 ft	SI = .45
V2	66 ft	SI = .91
V3	69%	SI = 1.0
V4	3	SI = 0.9
V5	50%	SI = 1.0

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = .84$$

TY1 - Construction starts

V1	0 ft	SI = 0.3
V2	0 ft	SI = 0.2
V3	0%	SI = 0
V4	0	SI = 0
V5	0%	SI = 0.2

$$HSI = \frac{(0.3 \times 0 \times 0)^{1/3} + (0.2 \times 0.2)^{1/2}}{2} = \frac{0 + (.04)^{1/2}}{2} = .10$$

TY2 - Construction complete

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

TY52

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

Compensation Site
Future w/o Project (MP1)

Assumptions:

1. 10-acre compensation site (annual grassland)
2. Develop a mixed riparian area with at least 4 different woody plant species
3. Site width is a minimum of 200 ft.
4. Construction period is one year

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrub species
V5 - Understory vegetative density

TY0 - Baseline (estimated)

V1	0 ft	SI = 0.3
V2	0 ft	SI = 0.2
V3	0	SI = 0
V4	0	SI = 0
V5	0	SI = 0.2

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.3 \times 0 \times 0)^{1/3} + (.2 \times .2)^{1/2}}{2} = \frac{(0)^{1/3} + (.04)^{1/2}}{2} = .10$$

TY1 No change from TY0
TY2 No change from TY1
TY52 No change from TY2

Compensation Site
Future with Project (MP2)

TY0 - Baseline (estimated)

TY1

V1	3ft (new plantings)	SI = 0.3
V2	1ft (one tree wide)	SI = 0.2
V3	0	SI = 0
V4	4	SI = 1
V5	10%	SI = 0.4

$$HSI = \frac{(0.3 \times 0 \times 1)^{1/3} + (.0.2 \times .0.4)^{1/2}}{2} = \frac{(0)^{1/3} + (.02)^{1/2}}{2} = .14$$

TY2

V1	6 ft	SI = 0.3
V2	3 ft	SI = 0.2
V3	20%	SI = 0.4
V4	4	SI = 1.0
V5	20%	SI = .73

$$HSI = \frac{(0.3 \times 0.4 \times 1.0)^{1/3} + (.0.2 \times .73)^{1/4}}{2} = \frac{.49 + 38 = .44}{2} = .44$$

TY52

V1	43 ft	SI = 0.7
V2	200 ft	SI = 1.0
V3	93%	SI = 0.9
V4	4	SI = 1.0
V5	91%	SI = .63

$$HSI = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} + (.1.0 \times .63)^{1/4}}{2} = \frac{(.63 + 63)^{1/4}}{2} = \frac{.86 + .79}{2} = .83$$

Feather River/Jack Slough, Reach 3
Future w/o Project (PA1)

Assumptions:

1. Existing maintenance will continue on levee
2 Tree height will increase (trees grow)
3. Stand width will increase slightly

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrubs
V5 - Understory vegetative density

TY0 - Baseline (measured)

V1	43 ft	SI = 0.7
V2	60 ft	SI = 0.8
V3	93%	SI = 0.9
V4	4	SI = 1.0
V5	91%	SI = .63

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} (0.8 \times .63)^{1/2}}{2} = \frac{(.63^{1/3} + (.50)^{1/2}}{2}$$

$$= \frac{.86 + .71}{2} = .79$$

TY1 No change from TY0
TY2 No change from TY1

TY52

V1	43 ft	SI = 0.7
V2	80 ft	SI = 1.0
V3	93%	SI = .90
V4	4	SI = 1.0
V5	91%	SI = .63

$$HSI = \frac{(0.70 \times .90 \times 1.0)^{1/3} + (1.0 \times .63)^{1/2}}{2} = \frac{(.63) + (.63)^{1/2}}{2} = \frac{.86 + .79}{2} = .85$$

Future w/Project (PA2)

Assumptions:

1. All woody vegetation removed
2. Future maintenance activities preclude development of woody vegetation within right-of-way
3. Construction period is one year

TY0 - Baseline (measured)

V1 43 ft SI = 0.7
V2 60 ft SI = 0.8
V3 93% SI = 0.9
V4 4 SI = 1.0
V5 91% SI = .63

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} (0.8 \times .63)^{1/2}}{2} = \frac{(.63^{1/3} + (.50)^{1/2}}{2}$$

$$= \frac{.86 + .71}{2} = .79$$

TY1 - Construction starts

V1 0 ft SI = 0.3
V2 0 ft SI = 0.2
V3 0% SI = 0
V4 0 SI = 0
V5 0% SI = 0.2

$$HSI = \frac{(0.3 \times 0 \times 0)^{1/3} + (0.2 \times 0.2)^{1/2}}{2} = \frac{0 + (.04)^{1/2}}{2} = .10$$

TY2 - Construction complete

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

TY52

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

Compensation Site
Future w/o Project (MP1)

Assumptions:

1. 10-acre compensation site (annual grassland)
2. Develop a mixed riparian area with at least 4 different woody plant species
3. Site width is a minimum of 200 ft.
4. The construction period is one year

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrub species
V5 - Understory vegetative density

TY0 - Baseline (estimated)

V1	0 ft	SI = 0.3
V2	0 ft	SI = 0.2
V3	0	SI = 0
V4	0	SI = 0
V5	0	SI = 0.2

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.3 \times 0 \times 0)^{1/3} + (.2 \times .2)^{1/2}}{2} = \frac{(0)^{1/3} + (.04)^{1/2}}{2} = .10$$

TY1 No change from TY0
TY2 No change from TY1
TY52 No change from TY2

Compensation Site
Future with Project (MP2)

TY0 - Baseline (estimated)

TY1

V1	3ft (new plantings)	SI = 0.3
V2	1ft (one tree wide)	SI = 0.2
V3	0	SI = 0
V4	4	SI = 1
V5	10%	SI = 0.4

$$HSI = \frac{(0.3 \times 0 \times 1)^{1/3} + (.0.2 \times .0.4)^{1/2}}{2} = \frac{(0)^{1/3} + (.02)^{1/2}}{2} = .14$$

TY2

V1	6 ft	SI = 0.3
V2	3 ft	SI = 0.2
V3	20%	SI = 0.4

V4 4 SI = 1.0
V5 20% SI = .73

$$HSI = \frac{(0.3 \times 0.4 \times 1.0)^{1/3} + (.0.2 \times .73)^{1/2}}{2} = \frac{.49 + 38 = .44}{2} = .44$$

TY52

V1 43 ft SI = 0.7
V2 200 ft SI = 1.0
V3 93% SI = 0.9
V4 4 SI = 1.0
V5 91% SI = .63

$$HSI = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} + (.1.0 \times .63)^{1/2}}{2} = \frac{(.63 + 63)^{1/2}}{2} = \frac{.86 + .79}{2} = .83$$

TY1 - Construction starts

V1 0 ft SI = 0.3
V2 0 ft SI = 0.2
V3 0% SI = 0
V4 0 SI = 0
V5 0% SI = 0.2

$$HSI = \frac{(0.3 \times 0 \times 0)^{1/3} + (0.2 \times 0.2)^{1/2}}{2} = \frac{0 + (.04)^{1/2}}{2} = .10$$

TY2 - Construction complete

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

TY52

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

Yuba River, Reach 3
Future w/o Project (PA1)

Assumptions:

1. Existing maintenance will continue on levee
2 Tree height will increase (trees grow)
3. Stand width will increase slightly

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrubs
V5 - Understory vegetative density

TY0 - Baseline (measured)

V1	43 ft	SI = 0.7
V2	60 ft	SI = 0.8
V3	93%	SI = 0.9
V4	4	SI = 1.0
V5	91%	SI = .63

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} + (0.8 \times .63)^{1/2}}{2} = \frac{(.63)^{1/3} + (.50)^{1/2}}{2}$$

$$= \frac{.86 + .71}{2} = .79$$

TY1 No change from TY0
TY2 No change from TY1

TY52

V1	43 ft	SI = 0.7
V2	80 ft	SI = 1.0
V3	93%	SI = .90
V4	4	SI = 1.0
V5	91%	SI = .63

$$HSI = \frac{(0.70 \times .90 \times 1.0)^{1/3} + (1.0 \times .63)^{1/2}}{2} = \frac{(.63) + (.63)^{1/2}}{2} = \frac{.86 + .79}{2} = .85$$

Future w/Project (PA2)

Assumptions:

1. All woody vegetation removed
2. Future maintenance activities preclude development of woody vegetation within right-of-way
3. Construction period is one year

TY0 - Baseline (measured)

V1 43 ft SI = 0.7
V2 60 ft SI = 0.8
V3 93% SI = 0.9
V4 4 SI = 1.0
V5 91% SI = .63

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} (0.8 \times .63)^{1/2}}{2} = \frac{(.63)^{1/3} + (.50)^{1/2}}{2}$$

$$= \frac{.86 + .71}{2} = .79$$

TY1 - Construction starts

V1 0 ft SI = 0.3
V2 0 ft SI = 0.2
V3 0% SI = 0
V4 0 SI = 0
V5 0% SI = 0.2

$$HSI = \frac{(0.3 \times 0 \times 0)^{1/3} + (0.2 \times 0.2)^{1/2}}{2} = \frac{0 + (.04)^{1/2}}{2} = .10$$

TY2 - Construction complete

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

TY52

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

Compensation Site
Future w/o Project (MP1)

Assumptions:

1. 10-acre compensation site (annual grassland)
2. Develop a mixed riparian area with at least 4 different woody plant species
3. Site width is a minimum of 200 ft.
4. The construction period is one year

Woodland Habitat

V1 - Average tree height
V2 - Average canopy width of stand
V3 - Tree canopy closure
V4 - Number of tree and/or shrub species
V5 - Understory vegetative density

TY0 - Baseline (estimated)

V1	0 ft	SI = 0.3
V2	0 ft	SI = 0.2
V3	0	SI = 0
V4	0	SI = 0
V5	0	SI = 0.2

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2} = \frac{(0.3 \times 0 \times 0)^{1/3} + (.2 \times .2)^{1/2}}{2} = \frac{(0)^{1/3} + (.04)^{1/2}}{2} = .10$$

TY1 No change from TY0
TY2 No change from TY1
TY52 No change from TY2

Compensation Site
Future with Project (MP2)

TY0 - Baseline (estimated)

TY1

V1	3ft (new plantings)	SI = 0.3
V2	1ft (one tree wide)	SI = 0.2
V3	0	SI = 0
V4	4	SI = 1
V5	10%	SI = 0.4

$$HSI = \frac{(0.3 \times 0 \times 1)^{1/3} + (.0.2 \times .0.4)^{1/2}}{2} = \frac{(0)^{1/3} + (.02)^{1/2}}{2} = .14$$

TY2

V1	6 ft	SI = 0.3
V2	3 ft	SI = 0.2
V3	20%	SI = 0.4

V4 4 SI = 1.0
V5 20% SI = .73

$$HSI = \frac{(0.3 \times 0.4 \times 1.0)^{1/3} + (.0.2 \times .73)^{1/2}}{2} = \frac{.49 + 38 = .44}{2} = .44$$

TY52

V1 43 ft SI = 0.7
V2 200 ft SI = 1.0
V3 93% SI = 0.9
V4 4 SI = 1.0
V5 91% SI = .63

$$HSI = \frac{(0.7 \times 0.9 \times 1.0)^{1/3} + (.1.0 \times .63)^{1/2}}{2} = \frac{(.63 + 63)^{1/2} = .86 + .79 = .83}{2}$$

TY1 - Construction starts

V1 0 ft SI = 0.3
V2 0 ft SI = 0.2
V3 0% SI = 0
V4 0 SI = 0
V5 0% SI = 0.2

$$HSI = \frac{(0.3 \times 0 \times 0)^{1/3} + (0.2 \times 0.2)}{2} \approx \frac{0 + (.04)}{2} \approx .10$$

TY2 - Construction complete

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

TY52

V1 - No change
V2 - No change
V3 - No change
V4 - No change
V5 - No change

HSI = .10

HEP APPENDIX B-3

HEP OUTPUT, FORM Ds

Area Needed For In-Kind Compensation
(Form H Results)

Date: 08/11/97

Study Name: YUBA RIVER, REACH 1 (CALTRANS)
Plan Alternative: PA 2 (with project) FUTURE WITH PROJECT
Compared To: PA 1 (without project) FUTURE W/O PROJECT
Management Plan: MP 1 (with project) FUTURE WITH PROJECT
Compared To: MP 2 (without project) FUTURE W/O PROJECT
Candidate management Area Size: 10.00

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
1	RIPARIAN FOREST	-0.22	5.18	0.42

Area Needed For In-Kind Compensation
(Form H Results)

Date: 08/21/97

Study Name: FEATHER RIVER/JACK SLOUGH, REACH 3
Plan Alternative: PA 2 (with project) FUTURE WITH PROJECT
Compared To: PA 1 (without project) FUTURE W/O PROJECT
Management Plan: MP 1 (with project) FUTURE WITH PROJECT
Compared To: MP 2 (without project) FUTURE W/O PROJECT
Candidate management Area Size: 10.00

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
1	RIPARIAN FOREST	-0.32	5.18	0.62

Area Needed For In-Kind Compensation
(Form H Results)

Date: 08/25/97

Study Name: YUBA RIVER, REACH 3
Plan Alternative: PA 2 (with project) FUTURE WITH PROJECT
Compared To: PA 1 (without project) FUTURE W/O PROJECT
Management Plan: MP 1 (with project) FUTURE WITH PROJECT
Compared To: MP 2 (without project) FUTURE W/O PROJECT
Candidate management Area Size: 10.00

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
1	RIPARIAN FOREST	-1.00	5.18	1.94

HEP APPENDIX B-3

**COMPENSATION ANALYSIS FOR THE
SACRAMENTO FLOOD CONTROL SYSTEM EVALUATION, PHASE II MITIGATION SITE
ON THE FEATHER RIVER**

MEMO

To: File

From: Doug Weinrich

Subject: Mitigation credit accounting for work deleted at worksite 6 of the Sacramento River Flood Control System Evaluation Project, Phase II (Yuba City/Marysville area)

Date: September 11, 1997

Jane Rinck, Mike Welsh, and I met to discuss the mitigation credits available at the Sacramento River Flood Control System Evaluation Project, Phase II mitigation site as a result of the Corps deleting proposed work at worksite 6. The reason for the accounting now is the Corps wants to use any credits to meet their mitigation needs from the proposed Yuba River Basin Investigation.

A. Based on a review of the work deleted the following mitigation credits were identified:

Original Worksite 6 Impacts	Original Worksite 6 Mitigation Need	Work Deleted at Worksite 6	Current Mitigation Need	Change (Credit)
riparian woodland (2.20 acres)	5.97 acres	2.20 acres	0	5.97 acres
riparian scrub-shrub (1.57 acres)	5.31 acres	1.57 acres	0	5.31 acres
elderberry (37 shrubs)	56.5 acres	28 shrubs not impacted	9 shrubs moved (13.74 acres)	42.76 acres
			TOTAL	54.04

B. The following credits have been used:

1997 Flood Damage (mitigation site)	4.0 acres (riparian)
1997 Flood Damage (RD 1660/70)	5.0 acres (riparian)
1997 Flood Damage (RD 784)	3.0 acres (riparian)
	12.0 acres

C. Current Mitigation Credits: 54.04 acres (surplus)
12.00 acres (1997 Flood damage commitments)
42.04 acres

D. Yuba River Basin Mitigation Needs (as of September 18, 1997; does not include any endangered species mitigation, if needed):

2.98 acres of woodland (riparian)

E. Long Term Mitigation Credits: **39.06** acres

In order to use these credits it is recommended the Service work with the Corps to establish a mitigation bank in accordance with the Federal Mitigation Banking guidelines.

APPENDIX B

CULTURAL RESOURCES MEMORANDUM OF UNDERSTANDING

DRAFT
MEMORANDUM OF AGREEMENT
BETWEEN THE U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
SUBMITTED TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION PURSUANT TO 36 CFR 800.6 (a)

WHEREAS the U.S. Army Corps of Engineers, Sacramento District (Corps) had determined that the Yuba River Feasibility Study project may have adverse effects on properties that are eligible for the National Register of Historic Places, and has consulted with the California State Historic Preservation Officer (SHPO) in accordance with Section 106 of the National Historic Preservation Act, 16 U.S.C. 470 (the Act), and its implementing regulations (36 CFR Part 800), and

WHEREAS, the Corps is undertaking a feasibility study of flood control alternatives for the Yuba River basin and has conducted previous cultural resources investigations in the study area that indicate that the area has a high sensitivity for undiscovered cultural resources, and

WHEREAS, the Corps has determined that approximately 75 percent of the project area has previously been surveyed for cultural resources, and

WHEREAS, when funding becomes available during future planning phases of the Yuba River Feasibility Study and the Area of Potential Effect is more clearly defined, the following stipulations shall be implemented, and

NOW, THEREFORE, the Corps and the California SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Project on historic properties.

Stipulations

The Corps will ensure that the following stipulations are implemented:

1. Survey.

The Corps shall ensure that an inventory of the unsurveyed project area for the Yuba River Feasibility Project is conducted, in a manner consistent with the Secretary of the Interior's Standards and Guidelines for Identification (48 FR 44720-23) and taking into account National Park Service publication, The Archeological Survey: Methods and Uses (1978: GPO stock # 024-016-00091). The survey shall be conducted in consultation with the SHPO, in accordance with 36 CFR 800.4 (a)(b).

2. Evaluation.
The Corps shall evaluate properties identified through the survey in accordance with 36 CFR 800.4(c). If the survey results in the identification of properties that are eligible for the National

Register, the Corps shall comply with 36 CFR 800.5.

3. Amendments.

Any party to this MOA may propose to the other party that it be amended, whereupon the parties will consult in accordance with 36 CFR 800.5(e) to consider such an amendment.

4. Termination

Any party to this agreement may terminate it by providing thirty (30) days notice to the other parties, provided that the other parties continue to consult during the period prior to the termination to seek agreement on amendments or other actions that would avoid termination. In the event of termination, the Corps will comply with 36 CFR 800.4 through 800.6 with regard to the undertaking covered by this agreement.

Execution of this MOA by the Corps and the California SHPO, its subsequent acceptance by the Advisory Council on Historic Preservation (Council), and implementation of its terms, evidence that the Corps has afforded the Council an opportunity to comment on the undertaking and its effects on historic properties, and that the Corps has taken into account the effects on historic properties.

U.S. ARMY CORPS OF ENGINEERS

BY: _____ Date: _____
Commander, Sacramento District

CALIFORNIA STATE HISTORIC PRESERVATION OFFICER

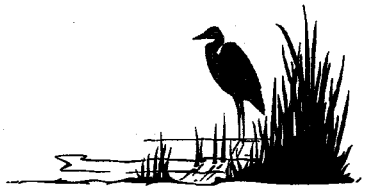
BY: _____ Date: _____
State Historic Preservation Officer

ACCEPTED for the Advisory Council on Historic Preservation

BY: _____ Date: _____

APPENDIX C

ENDANGERED SPECIES COORDINATION



FACSIMILE TRANSMITTAL HEADER SHEET

For use of this form, see AR 25-11; the proponent agency is ODISC4

COMMAND/ OFFICE	NAME/ OFFICE SYMBOL	OFFICE TELEPHONE NO. *(AUTOVON/Comm.)*	FAX NO. *(AUTOVON/Comm.)*
FROM: U.S. Army Corps of Engineers Environmental Resources Branch	Jane Rinck	(916) 557-6715	(916) 557-7856
TO: U.S. Fish and Wildlife Service Section 7 Program	Harry Mossman	(916) 979-2105 x311	(916) 979-2723

CLASSIFICATION	PRECEDENCE	NO. PAGES *(Including this Header)*	DATE-TIME	MONTH	YEAR	RELEASER'S SIGNATURE
		1	23	July	97	

REMARKS
Please see below

Space Below For Communications Center Use Only

DA FORM 3918-R, JUL 90 DA FORM 3918-R, AUG 72 IS OBSOLETE USAPPC V3.00

Harry:

Per our telephone conversation yesterday, would you please prepare and fax to me a list of species of concern that may occur in the vicinity of the following quads: Nicolaus, CA, Yuba City, CA, Olivehurst, CA, Browns Valley, CA (U.S.G.S. 7.5' Quads). The Corps of Engineers and DWR is conducting a Feasibility Study to increase flood protection for the Marysville, Linda, and Olivehurst areas. Project alternatives would include slurry walls, levee berms, and toe drains. The draft EIS/EIR is scheduled to be completed in December 1997.

I would appreciate an initial copy of the list via fax and a formal copy can be sent through the mail to:
USACE-PD-R
Attn: Jane Rinck
1325 J Street
Sacramento, CA 95814

Thank-you very much for your help. If you have any questions, please call me at 557-6715.

Jane Rinck

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

IN REPLY REFER TO:
1-1-97-SP-1791

August 1, 1997

Ms. Jane Rinck
Department of the Army
US Army Engineer District, Sacramento
1325 J Street
Sacramento, California 95814-2922

Subject: Species Lists for a Feasibility Study to Increase Flood Protection for the Areas around Marysville, Linda and Olivehurst, California

Dear Ms. Rinck:

As requested by letter from your agency dated July 23, 1997, you will find enclosed lists of sensitive species that may be present in *or may be affected by* projects in the subject project area (see Enclosure A). These lists fulfill the requirement of the Fish and Wildlife Service (Service) to provide species lists pursuant to section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The animal species on the Enclosure A quad list are those species we believe may occur within, *or be affected by projects within*, the USGS Nicolas, Yuba City, Olivehurst, and Brown's Valley US Geological Survey 7½ minute quads, where your project is planned.

Any plants on the Enclosure A quad list are those *that have actually been observed* in the project quads. The Service recommends that you survey in each quad for plants shown on any of the Enclosure A lists for nearby quads.

Some of the species listed in Enclosure A may not be affected by the proposed action. A trained biologist or botanist, familiar with the habitat requirements of the listed species, should determine whether these species or habitats suitable for these species may be affected by the proposed action. For plant surveys, the Service recommends using the enclosed Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species (Enclosure C).

Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is available upon request. This information may be helpful in preparing the biological assessment for this project, if one is required. Please see

Ms. Jane Rinck

Enclosure B for a discussion of the responsibilities Federal agencies have under section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal agency or its designated non-Federal representative.

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.

Candidate species are currently being reviewed by the 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.

In the Federal Register of February 28, 1996, the Service changed its policy on candidate species. The term *candidate* now strictly refers to species for which the Service has on file enough information to propose listing as endangered or threatened. Former *category 2* candidate species - species for which listing is possibly appropriate but for which the Service lacks sufficient information to support a listing proposal - are now called *species of concern*. They are no longer monitored by the Service. However we have retained them on the enclosed list for general information. We encourage consideration of them in project planning, as they may become candidate species in the future.

Please contact Jan Knight, Sacramento Valley Branch Chief, at (916) 979-2120, if you have any questions regarding the enclosed list or your responsibilities under the Endangered Species Act. For the fastest response to species list requests, address them to the attention of the section 7 office assistant at this address. If you have any questions about possible impacts to other fish and wildlife, please contact Mike Fris at (916) 979-2107.

Sincerely,

Patricia Lemund

for Wayne S. White
Field Supervisor

Enclosures

ENCLOSURE A
Endangered and Threatened Species that May Occur in
or be Affected by Projects in the Following Selected Quads
Reference File No. 1-1-97-SP-1791
August 1, 1997

QUAD : 529A NICOLAUS

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Reference File No. 1-1-97-SP-1791

QUAD : 529A NICOLAUS

Species of Concern

Mammals

- Yuma myotis bat, *Myotis yumanensis* (SC)
- San Joaquin pocket mouse, *Perognathus inornatus* (SC)
- Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

- tricolored blackbird, *Agelaius tricolor* (SC)
- western burrowing owl, *Athene cunicularia hypugea* (SC)
- ferruginous hawk, *Buteo regalis* (SC)
- little willow flycatcher, *Empidonax traillii brewsteri* (SC)
- white-faced ibis, *Plegadis chihi* (SC)

Reptiles

- northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

- western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

- green sturgeon, *Acipenser medirostris* (SC)
- Pacific lamprey, *Lampetra tridentata* (SC)

Invertebrates

- Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)
- Sacramento anthicid beetle, *Anthicus sacramento* (SC)
- Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

QUAD : 543B BROWNS VALLEY

Listed Species

Birds

- American peregrine falcon, *Falco peregrinus anatum* (E)
- Aleutian Canada goose, *Branta canadensis leucopareia* (T)
- bald eagle, *Haliaeetus leucocephalus* (T)

Reference File No. 1-1-97-SP-1791

QUAD : 543B BROWNS VALLEY

Listed Species

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

spotted bat, *Euderma maculatum* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

QUAD : 543B BROWNS VALLEY

Species of Concern

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Amphibians

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

QUAD : 544A YUBA CITY

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Reference File No. 1-1-97-SP-1791

QUAD : 544A YUBA CITY

Listed Species

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Plants

Hartweg's golden sunburst, *Pseudobahia bahiifolia* (E)

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

QUAD : 544A YUBA CITY

Species of Concern

Birds

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

Plants

Ferris's milk-vetch, *Astragalus tener var. ferrisiae* (SC)

QUAD : 544D OLIVEHURST

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

giant garter snake, *Thamnophis gigas* (T)

Amphibians

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

Fish

delta smelt, *Hypomesus transpacificus* (T)

Invertebrates

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

Reference File No. 1-1-97-SP-1791

QUAD : 544D OLIVEHURST

Listed Species

Invertebrates

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

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

Proposed Species

Fish

Central Valley steelhead, *Oncorhynchus mykiss* (PE)

Candidate Species

Birds

mountain plover, *Charadrius montanus* (C)

Species of Concern

Mammals

Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Joaquin pocket mouse, *Perognathus inornatus* (SC)

Pacific western big-eared bat, *Plecotus townsendii townsendii* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

western burrowing owl, *Athene cunicularia hypugea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (SC)

white-faced ibis, *Plegadis chihi* (SC)

QUAD : 544D OLIVEHURST

Species of Concern

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

Invertebrates

Antioch Dunes anthicid beetle, *Anthicus antiochensis* (SC)

Sacramento anthicid beetle, *Anthicus sacramento* (SC)

Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta* (SC)

Plants

veiny monardella, *Monardella douglasii ssp. venosa* (SC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened.
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(*)		Possibly extinct.
	Critical Habitat	Area essential to the conservation of a species.

Enclosure B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER
SECTIONS 7(a) and (c) OF THE ENDANGERED SPECIES ACT

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 informally verified with our 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 in the BA: an on-site inspection of the area affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat is present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirement; 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, and 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.

---

[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.

Enclosure C

GUIDELINES FOR CONDUCTING AND REPORTING BOTANICAL INVENTORIES
FOR FEDERALLY LISTED, PROPOSED AND CANDIDATE PLANTS

(September 23, 1996)

These guidelines describe protocols for conducting botanical inventories for federally listed, proposed and candidate plants, and describe minimum standards for reporting results. The Service will use, in part, the information outlined below in determining whether the project under consideration may affect any listed, proposed or candidate plants, and in determining the direct, indirect, and cumulative effects.

Field inventories should be conducted in a manner that will locate listed, proposed, or candidate species (target species) that may be present. The entire project area requires a botanical inventory, except developed agricultural lands. The field investigator(s) should:

1. Conduct inventories at the appropriate times of year when target species are present and identifiable. Inventories will include all potential habitats. Multiple site visits during a field season may be necessary to make observations during the appropriate phenological stage of all target species.

2. If available, use a regional or local reference population to obtain a visual image of the target species and associated habitat(s). If access to reference populations(s) is not available, investigators should study specimens from local herbaria.

3. List every species observed and compile a comprehensive list of vascular plants for the entire project site. Vascular plants need to be identified to a taxonomic level which allows rarity to be determined.

4. Report results of botanical field inventories that include:

   a. a description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species

   b. a map of project location showing scale, orientation, project boundaries, parcel size, and map quadrangle name

   c. survey dates and survey methodology(ies)

   d. if a reference population is available, provide a written narrative describing the target species reference population(s) used, and date(s) when observations were made

   e. a comprehensive list of all vascular plants occurring on the project site for each habitat type

   f. current and historic land uses of the habitat(s) and degree of site alteration

   g. presence of target species off-site on adjacent parcels, if known.

   h. an assessment of the biological significance or ecological quality of the project site in a local and regional context

5. If target species is(are) found, report results that additionally include:

   a. a map showing federally listed, proposed and candidate species distribution as they relate to the proposed project

   b. if target species is (are) associated with wetlands, a description of the direction and integrity of flow of surface hydrology. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.

c. the target species phenology and microhabitat, an estimate of the number of individuals of each target species per unit area; identify areas of high, medium and low density of target species over the project site, and provide acres of occupied habitat of target species. Investigators could provide color slides, photos or color copies of photos of target species or representative habitats to support information or descriptions contained in reports.

d. the degree of impact(s), if any, of the proposed project as it relates to the potential unoccupied habitat of target habitat.

6. Document findings of target species by completing California Native Species Field Survey Form(s) and submit form(s) to the Natural Diversity Data Base. Documentation of determinations and/or voucher specimens may be useful in cases of taxonomic ambiguities, habitat or range extensions.

7. Report as an addendum to the original survey, any change in abundance and distribution of target plants in subsequent years. Project sites with inventories older than 3 years from the current date of project proposal submission will likely need additional survey. Investigators need to assess whether an additional survey(s) is (are) needed.

8. Adverse conditions may prevent investigator(s) from determining presence or identifying some target species in potential habitat(s) of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. An additional botanical inventory(ies) in a subsequent year(s) may be required if adverse conditions occur in a potential habitat(s). Investigator(s) may need to discuss such conditions.

9. Guidance from California Department of Fish and Game (CDFG) regarding plant and plant community surveys can be found in Guidelines for Assessing the Effects of Proposed Developments on Rare and Endangered Plants and Plant Communities, 1984. Please contact the CDFG Regional Office for questions regarding the CDFG guidelines and for assistance in determining any applicable State regulatory requirements.

January 21, 1998

Environmental Resources Branch

Wayne White, Field Supervisor
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

Dear Mr. White:

This is our biological assessment for the Yuba River Basin Investigation environmental impact statement/environmental impact report (EIS/EIR). We are enclosing a copy of the Feasibility Report and EIS/EIR which describes potential effects of the proposed project on Federally listed and proposed endangered and threatened species and candidate species within the project area. The species included in the EIS/EIR were identified in a letter from your office dated August 1, 1997 (Ref# 1-1-997-SP-1791).

According to the species list in the August 1997 letter, the Federally listed species include the American peregrine falcon, Aleutian Canada goose, bald eagle, giant garter snake, California red-legged frog, delta smelt, vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, and Hartweg's golden sunburst. The Federally proposed species is the Central Valley steelhead.

It is our biological assessment that the proposed project may adversely affect the Federally listed giant garter snake and valley elderberry longhorn beetle. However, we do not anticipate any adverse effects on the other Federally listed and proposed species and their habitat because (1) they are not likely to occur in the study area due to lack of suitable habitat, (2) there are no known occurrences near the study area, and/or (3) existing habitat is far enough from the work sites that the habitat or species would not be disturbed during construction.

Field visits have confirmed the existence of suitable habitat for the giant garter snake in reach 3 between levee miles 2.0 and 3.0. This habitat includes rice fields and drainage ditches about 50 feet from the existing levee toe on the waterside of the levee. Since current data show that giant garter snakes are currently distributed in rice production areas close to the study area, it is possible that they may occur in this portion of the project area. However, by implementing

the following avoidance measures, project construction is not expected to adversely affect the giant garter snake or its habitat.

- Construction activity would be confined within or near potential habitat to the period between May 1 and October 31.
- Prior to construction activities, a qualified biologist would instruct all construction personnel in worker awareness training to recognize garter snake and its habitat.
- Prior to construction activities, the site would be inspected by a qualified biologist who has the necessary collection permits and is approved by the Sacramento Field Office of the FWS to minimize and avoid the killing and harassing of giant garter snakes.
- Nearby habitat designated as environmentally sensitive to the snake would be flagged and avoided by all construction personnel.
- Movement of heavy equipment to and from the project site or borrow site would be confined to existing roadways to minimize habitat disturbance. Equipment would stay at least 30 feet from the banks of giant garter snake aquatic habitat.
- Any dewatered habitat would remain dry for at least 15 consecutive days prior to construction.
- If a giant garter snake is encountered during construction, activities would cease until capture and relocation have been completed by the FWS-approved biologist. Any incidental take would be reported to the FWS immediately by telephone at (916) 979-2725.

Although the valley elderberry longhorn beetle was not found in the project area, field visits identified three host elderberry shrubs within the construction right-of-way in reach 3 along the Yuba River near levee mile 1.0. These shrubs would removed by construction activities at the site. Preliminary, informal consultation with your office was initiated for the three elderberry shrubs affected by the project. Mitigation for the beetle was analyzed using the "General Compensation Guidelines for the Valley Elderberry Longhorn Beetle" dated February 26, 1993. Prior to construction, the three shrubs would be transplanted, and an additional 0.37 acre of habitat would be needed. The mitigation would take place at the existing mitigation site for Phase II of the System Evaluation. Mitigation "credits" for work deleted from the project are available at that site for effects to the beetle. These mitigation measures would reduce adverse effects to less than significant.

Additional information on listed, proposed, and candidate species is summarized in the EIS/EIR. The EIS/EIR is currently being circulated for public review and comment. All comments will be considered and incorporated into the EIS/EIR as appropriate. A final EIS/EIR will then be prepared, and preconstruction activities could be initiated. If any adverse effects to any of the other listed or proposed species becomes apparent during this process, we will supplement this biological assessment with that new information. Also, if the status of any of the candidate species changes to proposed during construction, an additional assessment will be prepared.

We request your concurrence with our finding of no effect to the American peregrine falcon, Aleutian Canada goose, bald eagle, giant garter snake, California red-legged frog, delta smelt, vernal pool tadpole shrimp, vernal pool fairy shrimp, valley elderberry longhorn beetle, and Hartweg's golden sunburst.

Thank you for your cooperation and effort on this project. If you have any questions, please contact Jane Rinck at (916) 557-6715.

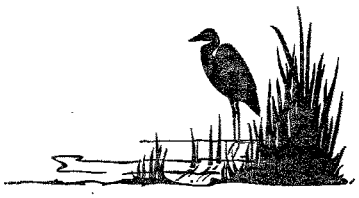
Sincerely,

Walter Yep
Chief, Planning Division

Enclosure

APPENDIX D

COMMENTS AND RESPONSES



FINAL ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT
APPENDIX D

COMMENTS AND RESPONSES

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COMMENT LETTERS

Introduction

The draft Yuba River Basin Investigation Feasibility Report (FR) and Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was completed and distributed for public review and comment in February 1998. This appendix contains the comments that were received during the review period, which ended on March 23, 1998, as well as the responses to those comments. Lengthy comments are summarized or partially quoted. When the same comment is made by several commentors, the response is given once and then subsequently referenced. Copies of the original correspondence are included after the comments and responses.

A public hearing was held in Marysville in March. Members of the public viewed the displays and discussed issues with Corps representatives. A court reporter was provided, and the public was encouraged to submit oral or written comments. No formal comments were received.

All responses can be considered as part of the final FR and EIS/EIR. The Corps and non-Federal sponsor wish to thank the commentors for taking the time and effort to participate in the public review process.

FEDERAL AGENCIES

1. Letter from U.S. Environmental Protection Agency dated March 31, 1998

Water Quality

a. Comment: ". . . the document should specifically identify the location of the proposed work in relation to the Corps jurisdictional area pursuant to Section 404 of the Clean Water Act. We recommend that the FEIS/R include an illustration and a clear description of the proposed project's spacial relationship with the Yuba and Feather Rivers."

Response: The following text has been added to the seventh paragraph in Section 3.2.4:

"The levees along the Yuba and Feather Rivers in the project area are set back from the rivers. The distances between the proposed levee work sites and the rivers vary depending on the reach and location of the site. The distances of the work sites from the rivers vary from about one-fourth mile to 2 miles in reach 2 and from about one-sixteenth mile to one-half mile in reach 2. The distances of the work sites from the rivers and Jack Slough vary from about one-sixteenth mile to one-half mile."

b. Comment: "The FEIS/R should indicate whether the proposed project requires a stormwater permit for the construction phase. . . . One of the requirements of this permit is the adoption of a STORMWATER POLLUTION PREVENTION PLAN. If a stormwater permit is necessary, this information should be included and discussed within Section 5.8, ..."

Response: The State Regional Water Quality Control Board has been added to the agencies in Section 5.8.2. The following text has been added concerning a stormwater permit:

"An NPDES general permit for construction activities will be acquired from the Central Valley Regional Water Quality Control Board, and a stormwater pollution prevention plan will be developed per the guidelines of the general permit. The NPDES permit will be acquired before construction activities begin. Appropriate water quality certification from the Central Valley Regional Water Quality Control Board will be acquired."

Hazardous, Toxic, and Radioactive Wastes (HTRW)

c. Comment: EPA is concerned that the results of HTRW investigations during PED and any resulting required mitigation measures would not be

incorporated into the current NEPA documents and the Corps Record of Decision. They recommend that the additional HTRW studies be conducted during the current feasibility phase and the results from these studies included into the FEIS/R.

Response: The environmental effects of any HTRW sites identified or analyzed further during the Planning, Engineering, and Design phase would be fully evaluated in a supplemental environmental assessment to the EIS/EIR. The draft supplemental assessment would be circulated to all interested parties and oversight agencies for review, and all comments would be considered and incorporated in the final document as appropriate. Construction would not be initiated until all HTRW concerns were resolved. As a result, we do not feel that additional HTRW studies are necessary during the current feasibility phase.

d. Comment: "The FEIS/R should include an accounting of the various State and Federal agencies . . . who have regulatory responsibility for managing HTRW substances."

Response: Section 3.2.8 has been revised to include the names of the regulatory agencies: U.S. Environmental Protection Agency, State of California Emergency Services Office, and Yuba County Office of Emergency Services.

Cumulative Impacts

e. Comment: "We do not agree that 'there would be no indirect cumulative effects because the proposed project would not encourage additional future development in the flood plains.'. . . once levees are introduced, we believe the public could perceive that higher density growth . . . may be acceptable. . . . encouraging such development. Therefore, levees do have the indirect/cumulative effect of potentially inducing growth on the lands that they were designed to protect. Further discussion on the indirect/cumulative impacts should be included in the FEIS/R."

Response: Yuba County and the City of Marysville already have plans for future growth and development in the study area. Future projections in these plans assume local flood protection from a 1 in 100 annual event. Since all development would be in accordance with local regulations and policies, we do not feel that the proposed project would indirectly induce new growth (or contribute to cumulative effects) in the flood plain. The following text has been added to Section 5.2.3:

"Growth in the area is already planned by the County and City of Marysville, and future growth projections assume local flood protection from a 1 in 100 annual event in most areas. All future growth would be consistent with existing local policies regarding land use, flood protection, and public safety. All properties would be developed in accordance with the adopted General Plans, land use designations, and zoning regulations."

Editorial Comment

f. Comment: "It appears that information is missing in Section 3.2.6 Socioeconomics, at the end of page DEIS 3-11."

Response: The text continues on page EIS 3-12 (after Table 3-2 in the draft). No information is missing in the section.

STATE AGENCIES

2. Letter to the Reclamation Board from the Department of Fish and Game dated March 3, 1998

a. Comment: The DFG supports the FWS in their request [in a letter dated January 21, 1998] for mitigation for loss of elderberry savannah habitat during levee maintenance work along the Yuba River [LM 4.25 to LM 6.13] on or about September 30, 1997.

Response: The Phase II project included modifications to the reach referred to as the "patrol road" (LM 4.25 to LM 6.13) on the south side of the Yuba River. Project effects were determined, and mitigation was developed for the entire Phase II project including the "patrol road." Eighty acres of mitigation land were acquired for the entire project, and plantings proceeded. The "patrol road" had a large number of elderberry shrubs as well as other habitat, resulting in a significant amount of mitigation (54 acres). Subsequently, the "patrol road" was deleted from the Phase II project. However, the mitigation was well underway, and it was deemed appropriate to complete the mitigation plantings and make necessary adjustments in the future for the actual mitigation needs. Phase II construction has not been completed, and the final accounting has not yet taken place.

During the development of the plan for the Yuba River Basin study, it was determined that to achieve a higher level of flood protection, the "patrol road" would now be required to act as a levee and would need to be modified and included in the Yuba River Basin project. Between the time that the "patrol road" was deleted from the Phase II project (1996) and the Corps determined a need for it in the Yuba River Basin project (1998), the elderberry shrubs were removed from the "patrol road" levees during levee maintenance activities.

The Yuba River Basin project cannot expend project funds for mitigation for effects not directly caused by the project. The Phase II project can only legally mitigate for the effects that it actually caused. During the final accounting for the Phase II project, a compensation agreement between the Corps and the State will likely be worked out for the mitigation work already completed. It is likely that endangered species consultation will be reinitiated for the Phase II project to delete the "patrol road" work from the project. The FWS may pursue other remedies through the Endangered Species Act to seek appropriate mitigation for the loss of endangered species habitat.

b. Comment: The DFG notes that the FWS's January letter further states that "there will be a 4.07-acre mitigation site deficiency due to the elderberry savannah habitat that was removed. . . ." The DFG owns over 2,000 acres of

riparian habitat along the Feather River and suggests that a new mitigation site be located to enhance the wildlife values of DFG lands.

Response: The FWS' January letter states that after the "patrol road" work was deleted from the Phase II project, the excess of mitigation lands was thought to be available as credits for future uses. Since then, FWS and the Corps have made commitments to use some of these credits for work conducted to repair levees damaged during the 1997 floods and for mitigation for the Yuba River Basin project. If mitigation for the elderberry bushes removed at the "parol road" are added back to the mitigation site together with these two commitments, there is an over-commitment of 4.07 acres. The over-commitment is not attributed to the Yuba River Basin project. It is a result of FWS's request to mitigate for the removal of the elderberry bushes from the "patrol road" and prior commitments of mitigation credits at the site. As noted in the response to comment #1, the Yuba River Basin project cannot mitigate for effects not directly caused by the project. If the FWS pursues action through the Endangered Species Act for mitigation for the removal of the elderberry shrubs, then the appropriate agencies would seek a solution for the over-commitment of 4.07 acres.

c. Comment: ". . . When construction equipment is working out as far as 40 feet from the levee, a considerable amount of riparian habitat, wetlands or endangered species habitat could be impacted. The impacts of these easements are considerably more than the 2.98 acres of woodland mitigation called for on page DEIS 4-31."

Response: The proposed levee work sites and permanent and temporary construction easement areas were surveyed by the Corps and FWS prior to the evaluation of effects and development of mitigation measures. In reaches 1 and 2, work would be done on the top or landside of the levee so no riparian vegetation would be affected. In reach 3, slurry walls would be installed on the waterside of the levee. However, two types of construction methods (described in Chapter 2) would be used to avoid or minimize significant environmental effects. Project effects are described in Chapter 4 of the EIS/EIR. Mitigation was determined by performing a Habitat Evaluation Procedure, which is described in Chapter 4 and the FWS's Coordination Act Report (Appendix A).

d. Comment: DFG does not believe that environmental effects for slurry wall work between Country Club Road and the Star Bend Boat Ramp were mitigated by either Phase II or the proposed project. They "recommend that the appropriate habitat impacts be calculated and the habitat mitigation plan be modified to include these impacts."

Response: The slurry wall work on the Feather River between LM 17 and 19 (Country Club Road and the Star Bend Boat Ramp) is taking place under the

Phase II project. The current request to increase the 10-foot construction easement is being considered by the Corps and DWR. If the request is granted and additional mitigation is needed, the mitigation requirements for Phase II would be modified.

e. **Comment:** DFG asks that the western yellow-billed cuckoo and the bank swallow be added to the list of special status species and that mitigation measures be developed for the two species.

Response: The western yellow-billed cuckoo and the bank swallow are included in the list of special status species in Table 3-10 in the EIS/EIR. Since the project is not expected to adversely affect either of these species, no mitigation measures would be necessary.

f. **Comment:** The DFG concurs with the proposed mitigation measures for potential effects on the Swainson's hawk and the giant garter snake.

Response: Comment noted.

g. **Comment:** "This project will result in the destruction or adverse modification of . . . unless the habitat impacts listed in this letter are appropriately mitigated."

Response: Comment noted.

3. Letter to the Reclamation Board from the Department of Transportation dated April 2, 1998

Comment: "For the Yuba River Basin Flood Control Project an encroachment permit would be required for any work within State right of way."

Response: Comment noted.

LOCAL AGENCIES

4. Letter from Yuba County Water Agency dated March 23, 1998

a. Comment: "*Page II-2,3.* For reference purposes it would be helpful if the year was added to the Sacramento River Flood Control System Evaluation, Phase II - Marysville/Yuba City Area, and the Sacramento River Bank Protection Project paragraph."

Response: Both of these projects are ongoing. The first two sentences in the first paragraph on page II-3 have been changed to present tense, and the word "ongoing" has been added to the first sentence in the second paragraph. In addition, the following sentence has been added to the first paragraph: "The work is scheduled to be completed in 1998."

b. Comment: "*Page II-4.* Local, Yuba River Development Project paragraph. Change the year that New Bullards Bar Dam was completed from 1971 to the correct year of 1969."

Response: The date has been corrected.

c. Comment: "*Page II-9.* The third paragraph is a duplication of the second paragraph."

Response: The second paragraph has been deleted.

d. Comment: "*Page II-12,* Table II-2. The status of the work is relative to the date of the table. To provide clarity the suggestion is to include the date of the data in the title of the table."

Response: The heading "Status of Work" has been changed to "Status of Work as of ??."

e. Comment: "*Page III-3,* February 1986 paragraph second sentence. If possible please add when the peak flows were that created the 1 in 80 annual to 1 in 90 annual event."

Response: The peak flows for the 1 in 80 annual event to 1 in 90 annual event occurred on February 19 and 20 between 6 p.m. and 6 a.m. This information has been incorporated into the report.

f. Comment: "*Page IV-4* first paragraph. There is an inconsistency between what the text states and what the figure shows. The statement 'Figure

IV-4 shows approximately 150 feet of Ag gradation' is not consistent with the picture which shows 25 feet of degradation."

Response: The text has been changed to read: "Figure IV-4 shows that nearly 25 feet of degradation has occurred since the 1890's."

g. Comment: "*Page IV-22,* table IV-3 is confusing. What does the year column show?"

Response: The year column has been deleted from the table.

h. Comment: "*Page IV-29,* first paragraph. There were about 850 homes flooded not 100 homes."

Response: The number of homes has been corrected.

i. Comment: "*Page IV-35,* first paragraph. In the last sentence the depth of flooding should be changed to economic area, or changed to 'bold' numbers below circled letters. The text is not consistent with the figure."

Response: The words "depth of flooding" have been changed to "economic areas."

j. Comment: "*Page V-5,* New Upstream Storage." The Agency questions the validity of the third sentence from the end of the paragraph. They recommend either deleting the last three sentences or modifying them to read "that is some locations this would not be a problem."

Response: The last three sentences were revised as follows: "During normal flows, however, a new storage project below Englebright Dam could result in channel stability problems downstream in the Yuba or Feather Rivers."

k. Comment: "*Page V-8,* Re-regulate Oroville and New Bullards Reservoirs." The Agency indicates that additional study of this preliminary alternative "would have been nice," but they do not want to delay "moving forward with the work recommended in this study."

Response: Comment noted.

l. Comment: "*Page V-9,* Parks Bar Single-Purpose Reservoir." The Agency questions the accuracy of the last sentence.

Response: The last sentence has been changed to "The lack of economic feasibility precluded it from further consideration."

m. Comment: "*Page V-9*, Parks Bar and Narrows Multipurpose Reservoirs. . . . Specifically, what project did you look at and what was the basis of your economic analysis [to reach your conclusion]? . . . In your economic analysis did you determine what level of flood protection this storage [240,000 acre-feet) would provide?"

Response: The level of protection associated with 180,000 acre-feet on Parks Bar corresponded to a 1 in 200 annual event. The level of protection associated with 1,050,000 acre-feet would correspond to a 1 in 500 annual event. Based on updating numbers from the reconnaissance report, none of the reservoir alternatives were feasible.

n. Comment: "*Page VI-II and Table VI-10*, Reliability of Levee Performance. . . . In the Linda-Olivehurst area, with levees improved to provide the recommended 200-year level of protection, if a 200-year event occurred, there is only a 78% change that the flood would be successfully passed. Is my understanding correct?"

Response: The reliability of the proposed project corresponds to an 86 percent chance of non-failure in a 1 in 100 annual event or a 78 percent chance of non-failure in a 200-year event.

o. Comment: "*Page VII-4, 5th bullet*. . . . What does this [flood plain management plan] consist of? . . . If the YCWA and Reclamation Districts do not have authority [to impose restriction on anyone], who would need to do this?"

Response: The flood plain management plan would not require the placement of restrictions by State or local agencies. It is merely a plan prepared for operation and maintenance designed to reduce the effect of future flood events in the project area.

p. Comment: "*Appendix C, pages 7 & 8*, Interior Levee Criteria. Reference is made to north and south private levees. Where are these located?"

Response: The levees referred to as the south or left private levees include the levees within the project levees from river mile 5.0 to 6.0 as shown on the General Map - plate 31. The levees referred to as the north or right private levees include the levees from river mile 4.5 to the central overflow channel on plate 31 of Appendix C.

q. Comment: "*Appendix D, Attachment A, pages 6 & 7*. . . New Bullards Bar was completed in 1969."

Response: The date has been corrected.

r. Comment: "*Appendix D, Attachment A, pages 11 & 12*; Table 6. Chart data stops 12 years ago. Since this is a 1998 study please include data through 1997. Why was more current data not used?"

Response: The information in the report represents the most current information that was available at the time.

INDIVIDUALS

5. Letter from Fred Kawashima dated March 5, 1998

a. Comment: "The report did not address the other (Sutter County) side of the Feather River. Are there plans to upgrade those levees to the same level of protection, such that both sides of the river will be equally protected? Is another report forthcoming to address the Sutter County levees?"

Response: The Yuba River Basin Feasibility report addresses flood problems for the Marysville, Linda/Olivehurst, and lower RD 784 areas because the Yuba County Water Agency as the non-Federal sponsor cost shared in these studies to address the Yuba County area. Sutter County has not requested a similar Corps study to address the Sutter County levees.

6. Letter from Kevin Putman dated March 22, 1998

a. Comment: Mr. Putman is concerned that levee upgrades will not provide adequate or reliable flood protection to Yuba City based on passed storm events, levee failures, and flooding. He believes that "volume must be added within the levee system."

Response: The Yuba River Basin study considered a variety of preliminary plans to provide increased levels of flood protection in the study area. These plans included large bypasses and reservoirs, which would have increased floodwater capacity (volume) in the area. Unfortunately, none of these preliminary plans were economically feasible based on Federal criteria.

b. Comment: ". . . reservoirs, operated with a storage emphasis as all of them are, have never given us adequate flood protection . . . the solution is downstream in the floodplain itself."

Response: The existing system of reservoirs, levees, weirs, and bypasses in the Central Valley have reduced flooding and flood damages by billions of dollars during this century. Unfortunately, since most of the valley is a flood plain and weather conditions are largely unpredictable, no system will guarantee complete protection from flooding.

c. Comment: ". . . Levee upgrades aren't a wise choice because 1) we can't upgrade everything; 2) even upgraded levees can fail; 3) an upgraded system could still be overtopped--the system still lacks volume."

Response: Comment noted.

d. Comment: "River levels could be better regulated with a weir-operated, controlled flood area. And the key position for such a device is at the Sutter Basin . . . ."

Response: Bypasses and offstream storage plans have been considered in the area. Unfortunately, the plans require purchasing large expanses of land and relocating existing residents and infrastructure. Economic analyses indicate that the plans are not economically feasible, and are often opposed by local landowners and residents.

e. Comment: "If Sacramento officials can be convinced that it is in their best interests that we do not reinforce our levees locally, but instead establish a new controlled-flooding area, then they might invest in the proposal along with us."

Response: Comment noted.

f. Comment: "We need a system that prevents dangerous river levels and thus prevents the necessity of evacuations."

Response: Comment noted. Protecting lives and property is the top priority of any flood control plan.

g. Comment: "A controlled-flooding area would function as a large settling pond, removing the suspended particles from the water."

Response: In order to ensure the proper functioning (adequate capacity) of any "controlled-flooding area," such sediments would eventually need to be excavated and removed from the area.

h. Comment: Mr. Putnam believes that the conclusions of the local Coalition for Flood Control concerning acquisition costs may not be accurate.

Response: Comment noted.

i. Comment: "The most attractive aspect of this 'contained flood' proposal is that it is (in theory) the fastest way to add a high level of flood protection for the Yuba City / Marysville area."

Response: The development, evaluation, financing, and implementation of any plan require Federal, State, and local engineering, economic, and environmental studies, as well as approval and funding from government sources and local sources.

7. Letter from Dale Whitmore dated February 26, 1998

a. Comment: Page III-10, paragraph 3 . . . "There has been a locally supported effort to remove substantial amounts of sand and gravel from the Yuba River . . . . Is the removal of this sand/gravel a proper course of action considering the eventual consequences to the Feather River levees if there is not enough and/gravel to sustain a symmetrical or flat Feather River bed?"

Response: Some removal of the sand/gravel could take place, but because the sediment inflow is so important to the Feather River levee stability, a long-term monitoring project should be established.

b. Comment: Page V-8, paragraph 3 - Regulate Oroville and New Bullards Bar Reservoirs . . . "The statement is made that 'Local interests do not support the efforts to increase the flood control space allocation in these reservoirs.' Who are these 'local interests'. Has this view been stated in a letter or verbal form?"

Response: The Yuba County Water Agency has verbally stated that increasing flood control space in exchange for lowering other allocations would not be acceptable.

c. Comment: Page DEIS 4-32 . . . "This mitigation site has received abundant criticism from local leaders for being a potential floodway block when the vegetation matures. Have you received any objections about including the mitigation at the 78.5-acre site and how will you respond if those objections are raised by local leaders?"

Response: The Corps has received no objections to including the mitigation at the 78.5-acre site. Local leaders have all expressed support for the use of the 78.5-acre site. As a result, no such objections are anticipated.

d. Comment: Page VI-2 - Jack Slough Left Bank, Reach 3. "There is a 5' by 12' berm planned for the Marysville Levee. Which side of the levee is this berm planned?"

Response: The berm for the Marysville levee is to be constructed on the waterside of the levee as shown in the Basis of Design appendix (Figures 12 and 13). The purpose of the berm is to act as a clay cap to prevent seepage from flanking the slurry wall through the top of the wall.

e. Comment: Page VI-2 and Plate 13. "Why is there no levee upgrade project planned for Yuba River right bank mile 1.0 to 3.0?"

Response: The geotechnical profiles for the levees show that no work is needed for the Yuba River right bank miles 1.0 to 3.0.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

March 30, 1998

Jane Rinck
Sacramento District
U.S. Army Corps of Engineers
1325 "J" Street
Sacramento, California 95814

Dear Ms. Rinck:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement/Report (DEIS/R) for the **YUBA RIVER BASIN INVESTIGATION, YUBA COUNTY, CALIFORNIA.** Our comments on the DEIS/R are provided pursuant to the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and the Council on Environmental Quality's NEPA Implementing Regulations (40 CFR 1500-1508).

The DEIS/R assesses the environmental impacts associated with the U.S. Army Corps of Engineers and the State of California Reclamation Board's (non-Federal sponsor) proposal to increase flood protection to the lower Yuba River Basin, a portion of the Feather River Basin below the Oroville dam, and near the City of Marysville by: (1) raising levees, constructing or modifying berms and drains, and installing or modifying slurry walls along sections of the Yuba and Feather Rivers, and (2) installing slurry walls along the ring levee around the City of Marysville.

We have rated the DEIS/R **EC-2**, Environmental Concerns-Insufficient Information. Please refer to the attached "Summary of Rating Definitions and Follow-Up Actions" for a more detailed explanation of EPA's rating system. Our rating reflects the need for the Corps to provide additional information in the FEIS/R. Specifically, the FEIS/R should provide further discussion pertaining to the anticipated impacts upon both water quality and hazardous, toxic, and radioactive wastes. Our detailed comments are attached.

The EPA appreciates the opportunity to comment on the DEIS/R. Please send one copy of the FEIS/R to me (code: CMD-2) at the letterhead address when it is filed with EPA's Washington, D.C. office. If you have any questions concerning our comments, please call me at (415) 744-1584 or Mark Bartholomew of my staff at (415) 744-1522.

Sincerely,

David Farrel, Chief
Federal Activities Office

Attachments: 2
a) Summary of Rating Definitions and Follow-Up Actions
b) EPA comments on DEIS/R

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SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

EPA Comments: Draft EIS/R for the Yuba River Basin Investigation, California
March 1998

Water Quality

Section 3.2.4 analyzes the potential adverse effects upon water quality. Since the proposed construction/maintenance activities will not be directly adjacent to the Yuba and Feathers Rivers, the DEIS/R concludes that waters of the United States will not be adversely impacted since there will be no fill placed within these waters. Although this may be true, the document should specifically identify the location of the proposed work in relation to the Corps jurisdictional area pursuant to Section 404 of the Clean Water Act. We recommend that the FEIS/R include an illustration and a clear description of the proposed project's spacial relationship with the Yuba and Feather Rivers..

The FEIS/R should indicate whether the proposed project requires a stormwater permit for the construction phase. Any construction activity that disturbs more than five acres of soil requires a stormwater construction permit which would be issued by the California State Regional Water Quality Control Board. One of the requirements of this permit is the adoption of a STORMWATER POLLUTION PREVENTION PLAN. If a stormwater permit is necessary, this information should be included and discussed within Section 5.8, "Compliance with Applicable Laws, Policies, and Plans".

Hazardous, Toxic, and Radioactive Wastes (HTRW)

Section 3.2.8 in the DEIS/R mentions that an environmental assessment for potential HTRW sites was conducted by the Corps in 1997. This assessment recommended that the Corps conduct further investigation for all sites except for the trailer court and the pole-mounted transformer. As such, the Corps is proposing to conduct further HTRW investigation during the Planning, Engineering, and Design Phase, after this current feasibility study phase. The EPA is concerned with utilizing this approach since the subsequent findings of this future investigation would not be incorporated into the current NEPA document, thereby not allowing for a full public and agency disclosure of the potential environmental impacts. In addition, the mitigation measures required pursuant to NEPA would not be included within the FEIS, and more significantly, incorporated into the Corps' Record of Decision. We recommend that the additional HTRW studies be conducted during the current feasibility phase and the results from these studies included into the FEIS/R.

On page 3-18, the DEIS/R states that "if HTRW sites are identified in work areas..., the appropriate county agency would work with the owner to remediate the sites." The FEIS/R

should include an accounting of the various State and Federal agencies (i.e., the EPA, California Department Of Health Services, etc.) who have regulatory responsibility for managing HTRW substances.

Cumulative Impacts

In Section 5.2.3 "Evaluation of Cumulative Effects", we do not agree with the that "there would be no indirect cumulative effects because the proposed project would not encourage additional future development in the flood plains." This conclusion is based upon the existing land uses and the projected future growth as determined by the County's and Cities' General Plans. Given the frequency of past serious flooding in the Marysville and Yuba City areas, it would appear that moderate/high density development should be discouraged. However, once levees are introduced, we believe the public could perceive that higher density growth, particularly in the "newly protected floodplain areas" may be acceptable. This false sense of security may skew future planning decisions by encouraging such development. Therefore, levees do have the indirect/cumulative effect of potentially inducing growth on the lands that they were designed to protect. Further discussion on indirect/cumulative impacts should be included in the FEIS/R.

Editorial Comment

It appears that information is missing in Section 3.2.6 Socioeconomics, at the end of page DEIS 3-11.

STATE OF CALIFORNIA - THE RESOURCES AGENCY PETE WILSON, Governor

DEPARTMENT OF FISH AND GAME
REGION 2
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CALIFORNIA 95670
Telephone (916) 358-2900

March 3, 1998

MAR 0 6 1998

Mr. Peter D. Rabbon, General Manager
The Reclamation Board
1416 Ninth Street, Room 1601
Sacramento, California 95814-5509

Dear Mr. Rabbon:

The Department of Fish and Game (DFG) has reviewed the Reclamation Board's Draft Feasibility Report, Appendixes and Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Yuba River Basin Investigation (SCH 92123076) dated January 1998. The Reclamation Board has also requested in your letter of February 4, 1998 that "the DFG provide written findings, based on DFG's determination of whether the proposed project would result in the destruction or adverse modification of any endangered or threatened species, or result in the destruction or adverse modification of any habitat essential to the continued existence of any endangered or threatened species".

The project consists of improvements to the south levee of the Yuba River, the east levee of the Feather River, and the levee around the City of Marysville in Yuba County. The proposed work includes levee raising and construction of slurry walls and landside stability berms. The project would provide 200-year flood protection to Reclamation District No. 784, and 300-year flood protection to the City of Marysville.

Significant resources in the project area which may be impacted include wetlands, waterways, riparian habitat, and endangered species habitat.

Page DEIS 4-31 recommends that the 2.98 acres of woodland habitat to be mitigated be included in the 78.5 acre mitigation site located within the Feather River flood plain near the end of Anderson Avenue.

The DFG recommends that the following concerns be adequately addressed in the EIR/EIS prior to approval of this project:

1. The U. S. Fish and Wildlife Service letter of January 21, 1998 to the U. S. Army Corps of Engineers, Sacramento District states that portions of the south levee of the Yuba River from Levee Mile (LM) 4.25 upstream to LM 6.13 (the point where it meets the dredge tailings from the goldfield area), had supported a significant area of elderberry savannah habitat prior to September 30, 1997. On or about that date, the elderberry savannah habitat was removed and burned during levee maintenance work. The additional work proposed by the Reclamation Board on the south levee of the Yuba River would have impacted this elderberry savannah habitat. This topic was also discussed on page DEIS 4-32, paragraph 3. We support the U. S. Fish and Wildlife Service in their request for mitigation of this habitat loss as a necessary action to prevent this project from resulting in the destruction or adverse modification of habitat essential to the continued existence of any endangered or threatened species.

2. The U. S. Fish and Wildlife Service letter of January 21, 1998 to the U. S. Army Corps of Engineers, Sacramento District, further states that there will be a 4.07- acre mitigation site deficiency due to the elderberry savannah habitat that was removed between LM 4.25 upstream to LM 6.13 on the south levee of the Yuba River. This information is contrary to paragraph 4, page 2 of Appendix A which states that, "There will be no additional acreage needed for mitigation... ." The DFG owns over 2000 acres of riparian habitat along the Feather River. We suggest that, a new mitigation site be located to enhance the wildlife values of DFG lands. A mitigation site on the land side of the levee would provide a critical refuge for wildlife during periods of high water in the river bottoms.

3. The real estate requirement for the Tentatively Selected Plan (page VI-1) calls for a 10-foot permanent easement and construction would require another 30 feet of temporary easement. In some locations, the riparian habitat begins at the levee toe. When construction equipment is working out as far as 40 feet from the levee, a considerable amount of riparian habitat, wetlands or endangered species habitat could be impacted. The impacts of these easements are considerably more than the 2.98 acres of woodland mitigation called for on page DEIS 4-31.

4. On February 2, 1998, we received a Fish and Game Code §1600 Application requesting alteration of the Feather River floodplain for slurry wall construction between Country Club Road and the Star Bend Boat Ramp (Project Levee Mile 17 to 19) on the east bank of the Feather River. The application was submitted by the Arctic Slope Construction, Inc. It is our understanding that this project is part of the Sacramento River Flood Control System Evaluation, Phase 2 Project, but the need for a deeper slurry wall between LM 17.18 and LM 17.70 is mentioned on page VI-1, paragraph 4 of the EIS/EIR. The contractor indicates that an area greater than 10 feet from the levee will be needed to stockpile dirt from a 70-foot-deep trench. The two miles of slurry wall construction may impact several acres of riparian habitat, dozens of mature cottonwood trees, and several mature elderberry shrubs. We do not believe that these impacts were mitigated by either the " Phase 2" mitigations or the mitigation proposed by the EIS/EIR. We recommend that the appropriate habitat impacts be calculated and the habitat mitigation plan be modified to include these impacts.

5. Page TT-8, paragraph 1 lists the special status species which may be found in the project area. We would like to add the following species to that list:

   a.) Western yellow-billed cuckoo - *Coccycus americanus occidentalis*, state-listed endangered

   b.) Bank swallow - *Riparia riparia*, state-listed threatened

   Proposed mitigation measures should be developed for these two species.

6. The DFG concurs with the proposed mitigation measures for the potential impacts to suitable habitat for the Swainson's hawk, *Buteo swainsoni*, and for the Giant Garter Snake, *Thamnophis gigas*, as listed on page DEIS 4-38.

7. This project will result in the destruction or adverse modification of several acres of riparian habitat and wetlands essential to the continued existence of several endangered or threatened species unless the habitat impacts listed in this letter are appropriately mitigated.

If the DFG can be of further assistance, please contact Mr. Dale Whitmore, Associate Wildlife Biologist, telephone 530) 743-5068 or Ms. Edna Maita, Environmental Specialist, at telephone (916) 358-2921.

Sincerely,

David S. Zezulak
Environmental Specialist IV, Supervisor

cc: Mr. Dale Whitmore
Ms. Edna Maita
Warden Emmitt Lenihan
Mr. John Nelson
Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, California 95670

Mr. Doug Weinrich
U. S. Fish and Wildlife Service
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

DEPARTMENT OF TRANSPORTATION
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April 2, 1998

98YUB005
03-YUB-65 P.M. 13.60
Yuba River Basin Flood Control Project
Draft EIR/EIS

Ms. Annulena Bronson
The Reclamation Board
1416 Ninth Street, Room 1603
Sacramento, CA 95814

Dear Ms. Bronson:

Thank you for the opportunity to review and comment on the above referenced document.

COMMENTS:

- We found the report informative and the references potentially useful for Caltrans future Marysville Bypass and Third Feather River Bridge projects. For the Yuba River Basin Flood Control Project an encroachment permit would be required for any work within State right of way. For permit assistance, please contact Rich Jones at (916) 741-5374.

Please provide a copy of the final EIR document for our review. If you have any questions regarding these comments, please contact Ken Champion at (916) 324-6642.

Sincerely,

JEFFREY PULVERMAN, Chief
Office of Transportation
Planning - Metropolitan

YUBA
COUNTY

WATER
AGENCY

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March 23, 1998

Colonel Dorothy F. Klasse
U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Dear Colonel Klasse:

Thank you for your staff's presentation on the Yuba River Draft Feasibility Report dated January 1998, to the Yuba County Water Agency Board of Directors. We are pleased to see that there is justification for federal participation in additional flood protection. Our main interest is to proceed with the process to obtain authorization, appropriation and to complete the work as-quickly-as possible. We do not want to have making changes to the report delay the process.

In reviewing the report, we have several questions and comments. These are presented in the enclosed attachment. We would appreciate your consideration in answering the questions and/or making the suggested changes to the report.

Again, our main interest is to move ahead with the project, so additional flood protection can be achieved.

Sincerely,

Curt Aikens

Curt Aikens
Assistant Administrator
for Project Development

cc: Bob Childs

YUBA COUNTY WATER AGENCY COMMENTS ON YUBA RIVER BASIN DRAFT FEASIBILITY REPORT JANUARY 1998

1. *Page II-2, 3.* For reference purposes it would be helpful if the year was added to the Sacramento River Flood Control System Evaluation, Phase II – Marysville/Yuba City Area, and the Sacramento River Bank Protection Project paragraph.

2. *Page II-4*, Local, Yuba River Development Project paragraph. Change the year that New Bullards Bar Dam was completed from 1971 to the correct year of 1969.

3. *Page II-9*, The third paragraph is a duplication of the second paragraph.

4. *Page II-12*, Table II-2. The status of the work is relative to the date of the table. To provide clarity the suggestion is to include the date of the data in the title of the table.

5. *Page III-3*, February 1986 paragraph second sentence. If possible please add what the peak flows were that created the 1 in 80 annual to 1 in 90 annual event.

6. *Page IV-4 first paragraph.* There is an inconsistency between what the text states and what figure shows. The statement "Figure IV-4 shows approximately 150 feet of Ag gradation" is not consistent with the picture which shows 25 feet of degradation.

7. *Page IV-22, table IV-3* is confusing. What does the year column show?

8. *Page IV-29, first paragraph.* There were about 850 homes flooded not 100 homes.

9. *Page IV-35, first paragraph.* In the last sentence the depth of flooding should be changed to economic area, or changed to "bold" numbers below circled letters. The text is not consistent with the figure.

10. *Page V-5*, New Upstream Storage. We question the validity of the statement,"During normal flows, however, increased storage could result in channel stability problems downstream in the Yuba or Feather Rivers" for all storage locations. For example, a storage facility at Parks Bar would not store significant sediment since Englebright, which is just upstream, was designed to block sediment. Our recommendation is to either take out the last three sentences or modify them to say "that in some locations this would not be a problem".

11. *Page V-8*, Re-regulate Oroville and New Bullards Bar Reservoirs. This section says that this alternative would require extensive study. Our understanding was that the Reconnaissance Study made basically the same comment, but said that the re-regulation study would be done as part of the Feasibility Study. It would have been nice to have this information, but we do not want to hold up moving forward with the work recommended in this study.

12. *Page V-9*, Parks Bar Single-Purpose Reservoir. The last sentence says that "The high cost of extensive evacuation of loose foundation material at the Parks Bar site precluded it from further consideration." Is this true for this site? We thought that this was true for sites downstream, but not aware of this concern at the Parks Bar site.

13. *Page V-9*, Parks Bar and Narrows Multipurpose Reservoirs. The section concludes that the lack of economic feasibility precludes this site from further consideration. Over the years there have been a number of projects with various sizes and features considered for a Parks Bar site. Specifically what project did you look at and what was the basis of your economic analysis? If there were ways to pay for a project that would provide 240,000 AF of annual flood space at Parks Bar, we believe previous USCE studies said this would provide a standard project flood level of protection. In your economic analysis did you determine what level of flood protection this storage would provide?

14. Page VI-11 and Table VI-10, Reliability of Levee Performance. It appears there is only a 78% chance that the flood would be successfully passed. In the Linda-Olivehurst area, with levees improved to provide the recommended 200-year level of protection, if a 200-year event occurred, there is only a 78% chance that the flood would be successfully passed. Is my understanding correct?

15. *Page VII-4, 5th bullet.* The report states that "Within in 1 year after the date of signing a project cooperation agreement, prepare a flood plain management plan. What does this consist of? YCWA is only a financial participant in this effort and has no authority to impose any restrictions on anyone. Similarly we understand that the Reclamation Districts do not have authority in this area. If the YCWA and Reclamation Districts do not have authority, who would need to do this?

16. *Appendix C, pages 7 & 8*, Interior Levee Criteria. Reference is made to north and south private levees. Where are these located?

17. *Appendix D, Attachment A, pages 6 & 7.* Table 3 shows New Bullards Bar year built as 1966 and page 7 New Bullards Bar section shows year built as 1971. New Bullards Bar was completed in 1969.

18. *Appendix D, Attachment A, pages 11 & 12*, Table 6. Chart data stops 12 years ago. Since this is a 1998 study please include data through 1997. Why was more current data not used?

March 5, 1998

Planning Division,
US Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814-2922

Attention: A. Carter

Subject: Yuba River Basin Investigation Report

Dear Ms. Carter,

I downloaded the subject report from your website. It stated that per the NED plan, the levees of Reaches 1, 2, and 3 would attain 250, 200, and 300 (respectively) year levels of protection. These levees are on the Yuba County side of the Yuba and Feather Rivers.

The report did not address the other (Sutter County) side of the Feather River. Are there plans to upgrade those levees to the same level of protection, such that both sides of the river will be equally protected? Is another report forthcoming to address the Sutter County levees?

If you wish, please respond via my e-mail: fredhk@jps.net

Sincerely,

Fred Kawashima
12482 Krosens Rd
Marysville, CA 95901

March 22, 1998

To: Adrienne Carter,
Planning Division
U.S. Army Corps of Engineers

Hello Adrienne,

I have some thoughts that I would like to share regarding flood control in the Yuba City / Marysville area.

We, here in Sutter county, are about to commit ourselves to a long term tax; it is important that we make sure that we are investing our money wisely. I have serious doubts about the course of action that we are considering, i.e., levee "upgrades". We have spent, and will continue to spend, tens of millions of dollars trying to make these levees hold water--sometimes lots of water. Meanwhile, we have also spent hundreds of millions of dollars cleaning up after floods. That is, if you calculated the overall cost of our flood "protection", including its failures, that total would be enormous. Considering the money spent, we could already have a fabulous flood control system in place, but we do not.

The point that I want to make is this: the main problem with this flood control system is that it lacks volume between the levees. Any expenditure of funds that does not address this crucial matter will be, I believe, just another bad investment in a long line of bad investments. How do you address this issue? You add volume to the flood control system. How much volume? As much as it takes. I have read that the Community Coalition for Flood Control reached the conclusion that *water diversions*--more bypasses, etc.-- were "not feasible"; that land acquisition was just "too expensive." What would really be *too expensive* is a flood of Yuba City.

Levee upgrades might be feasible (affordable) but will it really give us the level of protection that we need? It's kind of like an airplane that needs repairs: suppose the wings are corroding near the point of failure. You don't have the money to make the proper repairs but you do have enough money to give the plane a new paint job. Is a paint job an acceptable solution just because it is affordable? You think that you can't afford to make the proper repairs when, actually, you can't afford not to. You don't really have a choice. We don't have any other choice if we want reliable flood protection; we must give the runoff a place to go when it comes off the mountain or it will select its own location.

Here are some reasons why I think we must add volume within the levee system:

A) True, the problem would be solved if we could dictate storage levels at Oroville dam. If we could get 50% of that reservoir dedicated to flood control Yuba City would have solid flood protection. But this cannot be a long term solution because this state needs water. This is not a problem that is going to go away--it is going to get worse. So how could storage reductions be a

long term solution to the problem? Alright, then we need more reservoirs, but the relatively small reservoirs proposed for the Yuba river can't possibly be enough to handle excessive runoff like we get during a pineapple express. Suppose the proposed reservoirs were in place during the Jan. 1997 storms. If a 3 million acre foot reservoir like Oroville is overwhelmed by such a storm how could a lesser reservoir perform any better on the Yuba? The Yuba river's runoff would have been reduced only marginally, while the Feather river and Sacramento river would have been unchanged, of course. Is that protection? Or from another angle: If the proposed reservoir(s) were in place right now, how full would it / they be? About 80% full, just like all of the other reservoirs. In other words, it would be in perfect position to be overwhelmed by a pineapple express, just like the other reservoirs are right now (Mar. 22). A lot of people immediately think reservoir when we are looking for flood control solutions, but the record is clear, and speaks for itself: the reservoirs, operated with a storage emphasis as all of them are, have never given us adequate flood protection. The pineapple express is the kind of storm that causes floods, and floods bring new talk about reservoirs. Ironically, the pineapple express is precisely the storm that reservoirs cannot handle. Conclusion: the solution is downstream, in the floodplain itself.

B) Can we build a network of levees that can withstand the runoff from a pineapple express? Even if we could upgrade the entire levee system, would that be the best way to spend such a vast amount of money? The way things go, just as soon as we had levees that wouldn't break, a storm would come along that would overtop them. Even with strong levees, we would still have, in my opinion, a volume-deficient levee system. Mark Twain once said that there are two types of levees: those that have been overtopped, and those that will be. We were approaching such a scenario last January, 1997: the reservoirs were all full, dumping water furiously--what if there had been one more major storm (one was predicted at the time) behind the last one? Where would all of that water have gone? Of course, as we know, you don't have to worry about water over-topping levees that will rupture first, and ours always have. And they always will unless we reduce the pressure placed upon them. We must reduce our expectations of what levees can do for us. There will always be a place that can break because we can't "upgrade" all 200-some miles of local levees (incidentally, I'm not sure I consider toe drains and slurry walls upgrades; if you want to see a <u>really</u> upgraded levee--one that should never break--go look at what has been done at the end of Country Club rd.) We have already seen an "upgraded" section of levee that had boils at McLatchey rd. Levee upgrades, on any kind of large scale such as that associated with this tax proposal, could very well be an enormous waste of money. A multi-million dollar, *upgraded* levee near Yuba City won't be worth a sack of sand if the old, *degraded* levee fails above or below town. Conclusion: Levee upgrades aren't a wise choice because 1) we can't upgrade everything; 2) even upgraded levees can fail; 3) an upgraded system could still be over-topped--the system still **lacks volume.**

C) Local levee upgrades are necessary up to a point; we need to strengthen obvious weak spots. However, we shouldn't start throwing money at the entire system. Our levees are very effective up to a point. We **know** what the levees can handle: we have many years of empirical evidence from which to draw. Using Yuba City as a reference, there is some river level (sorry, I haven't found time to research this) beyond which all modern breaks have occurred. Let's say that it is 68 feet. Last Jan. 97 we had 78 feet. Now, we can go about trying to make levees that will hold 80 feet with a high degree of confidence, but there is only one way to find out if they work, and I'm

sure that we would all be observing this experiment from places like Sutter, Wheatland, and Beale--evacuated. I'm also sure that even if all of Yuba City's new levees held, there would be a rupture *somewhere* else in the system. Why not take a different approach? Instead of trying to make the levees hold more water, why not make a system that **prevents** the water from exceeding the historical breaking point. River levels could be better regulated with a weir-operated, controlled flood area. And the key position for such a device is at the Sutter Basin, in the Robbins "bowl" that is surrounded by the Sacramento River on the west and south, the Tisdale weir on the north, and the Sutter bypass / Feather river on the east. This area is a deep floodplain (elev. ~20 feet), an area that could accommodate massive amounts of water. The problem is, we would have to erase the town of Robbins and relocate those who live in the region. But Robbins is a town that *never should have existed*; it is a creation of the government's reclamation projects of the early 1900s. The thrust of those projects was to make basin lands available for agriculture. However, when the levees went up people **moved in--to live in the basin.** This was the single biggest mistake in the entire history of settlement in this Sacramento Valley: the deepest flood plains should have remained in the flood control system. The reason is simple: deep flood plains can take the most water. For example, the Robbins "bowl" could accommodate 200-300 acre feet of water (a rough guess). The area is contained by levees on all sides (actually, we saw a demonstration of this kind of "contained flood" in the **north** basin last year, when a huge lake filled in the bowl on the north side of Tisdale weir--the Meridian levee break).

D) **Upgrades of our local levees will benefit only ourselves (in the Yuba / Sutter area)**. Therefore, we can't really expect anyone else to help us pay for such upgrades. The controlled flood option is different: when the flood control capacity of the levee system is increased, ALL communities along the river(s) will benefit, not just ours. And that includes Sacramento. Sacramento is also seeking better flood protection; they might be willing to help to finance a proposal such as this because it is in their interests to do so. Incidentally, it could be argued that as we strengthen our levees locally, it creates a greater risk of levee failure at Sacramento; they have always been able to rely upon us to "relieve pressure" up here, at the expense of our own homes and property. The Meridian and Arboga floods took a tremendous amount of pressure off of the system--probably about 500,000 acre feet of water. If Sacramento officials can be convinced that it is in their best interests that we do **not** reinforce our levees locally, but instead establish a new controlled-flooding area, then they might invest in the proposal along with us.

E) **The controlled-flooding option is the most reliable flood control option**: with levee upgrades, you never know how much is enough; the system has to be tested with the next high water event. We can only have a kind of vague idea as to how reliable the upgrades will be. On the other hand, the controlled-flooding concept is much more straight forward: it is a simple calculation of volume. It is a relatively simple thing to calculate how much additional volume is necessary for a desired reduction in river levels (and the "desired" river level is, as stated, the level below which no breaks have **ever** occurred; this river level has an amount of water that our levees can contain with a **high degree of reliability**). There is concern that new businesses and industry are hesitant about coming to the Yuba-Sutter area as long as the flood control issue is not resolved. There are those who think that it will be possible to attract new business / industry after we spend 150 million dollars on toe drains and slurry walls. I am not one of those people. I think that business / industry people would want to see a flood control improvement that was sure to

make a **dramatic** improvement. We need to be able to say "when the water comes, here's where it will go". If you still have a system that would force some **80 feet** of water between Marysville and Yuba City, regardless of the purported levee strength, you still have a dangerous system. We need a system that not only reduces the chance of failure, but one that **reduces the occurrence of evacuations also**. Evacuations amount to very bad press for our community, even without a flood. Stronger levees will not affect the amount of water between them, of course, and the evacuation order will still come at 77 feet, no matter how many slurry walls we have.
We need a system that **prevents dangerous river levels** and thus prevents the necessity of evacuations. This is necessary both to attract businesses and for our own well-being: evacuations are difficult on everyone, especially the elderly and disabled--the logistics are a nightmare for hospitals. Evacuations are a time of terrific stress and uncertainty as people worry about 1) the whereabouts / well-being of friends and relatives, 2) their own housing / shelter, 3) looting of their own property left behind, and 4) whether or not their property will be consumed by the river. Adding volume to the levee system will reduce the incidence of evacuations, levee upgrades will not.

F) Much of the mass of muddy flood water is, well, **mud**. The existing levee system does a good job of keeping that mud / silt / sand suspended in the whirling flows. If there was a way to remove the suspended particles from the water it would reduce 1) the volume of the flows past Sacramento to the delta, 2) the destructive / erosive energy of those flows, and 3) reduce the siltation of the delta / bay. A controlled-flooding area would function as a large settling pond, removing the suspended particles from the water. This is, of course, how the valley's alluvial soils came to be, and the levee system has always prevented new soil deposits. Meanwhile, soil is lost to wind erosion. A smart farming practice would be one that preserves farmland, **along with its soil.** Development is precluded if land is subject to flooding by design, and this would probably be the only sure way to insure that development would not devour a given piece of property.

G) The local Coalition for Flood Control (hastily) concluded that water diversion / more bypasses was "not feasible" because of the expense associated with land / property acquisition. That may be true if we, locally, have to foot the entire bill. However, the situation is different if Sacramento is involved, as stated. Also, the coalition's conclusions may be wrong for a different reason: it would not necessarily cost the full "asking price" of the land, because the land would still have significant value even though it would henceforth be subjected to flooding. There are two scenarios: 1) the current owner opts to retain his land; we need only pay him the amount that the land depreciates under the new controlled flood arrangement; and 2) the current owner opts to sell out entirely, but the land can be resold at its new appraised value (remember, the probability that this property floods in a given year would still be very low; the flooding only takes place in years of **extreme** runoff).

H) The most attractive aspect of this "contained flooding" proposal is that it is (in theory) the fastest way to add a high level of flood protection for the Yuba City / Marysville area. New reservoirs would take years; levee upgrades would take years. This is an option that could be implemented quickly: all that has to be done is to construct a weir(s) that will allow water to overflow into the Robbins bowl. Of course, we would have to relocate some people, too.

This is my idea; I am not a trained hydrologist, so I'm sure that there might be some fundamental flaws in this proposal. However, I think that the underlying concept is sound: the best way to keep water from flooding into cities is to allow it somewhere else to go. The best places are low, sparsely populated areas. If someone else can come up with a better plan, great!

Kevin Putman
Kevin A. Putman
2884 Coy Drive
Yuba City, CA 95993
E-mail: dputman@syix.com

YUBRIVIN.298
February 26, 1998

Adrienne Carter, Planning Division
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Ms. Carter:

I will be attending the March 3, 1998 public hearing at the Yuba County Courthouse. I will be asking these questions at that time and wanted to provide those answering questions at the meeting with an advance copy. My apologies for the late letter.

Questions on the Draft Feasibility Report, Appendixes and EIS/EIR Yuba River Basin Investigation, California January 1998

1. Page III-10, paragraph 3 - Statement is made that "the reason for this apparent lateral stability (in the Feather River channel bed location) is that the sediment supply from the tributaries (such as the Yuba River) has maintained a sandbed channel with a symmetrical cross section (flat river bed) along most of the study reach. An asymmetrical cross section (or V-shaped river bed) would result in bank failure and lateral migration of the river.

There has been a locally supported effort to remove substantial amounts of sand and gravel from the Yuba River under the premise that there is to much sand/gravel in the river and flooding will result along the Yuba River. Is the removal of this sand/gravel a proper course of action considering the eventual consequences to the Feather River levees if there is not enough sand/gravel to sustain a symmetrical or flat Feather River bed?

2. Page V-8, paragraph 3 - Reregulate Oroville and New Bullards Bar Reservoirs - This paragraph discusses increasing the flood control storage in Oroville and New Bullards Bar Reservoirs. The statement is made that "Local interests do not support the efforts to increase the flood control space allocation in these reservoirs." Who are these "local interests". Has this view been stated in a letter or verbal form?

3. Page DEIS 4-32 - Mitigation for the loss of habitat due to levees repairs is to be included in the 78.5 acre habitat compensation site located near the end of Anderson Avenue. This mitigation site has received abundant criticism from local leaders for being a potential floodway block when the vegetation matures. Have you received any objections about including the mitigation at the 78.5 acre site and how will you respond if those objections are raised by local leaders?

3. Page VI-2 - Jack Slough Left Bank, Reach 3 - There is a 5' by 12' berm planned for the Marysville Levee. Which side of the levee is this berm planned?

4. Page VI-2 and Plate 13 - Why is there no levee upgrade project planned for Yuba River right bank mile 1.0 to 3.0?

Sincerely,

Dale Whitmore

Dale Whitmore
1263 Nadene Drive
Marysville. CA 95901
530 743-5068